A BILL PUBLICATION

Rubber World

TECHNOLOGY/MARKETS/NEWS VOLUME 183, NO. 4 JANUARY 1981

2/19/81 C 4425-1 U

Fiber technology: looking for the next generation

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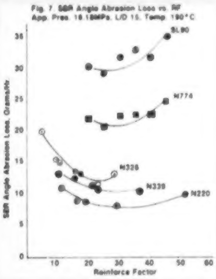

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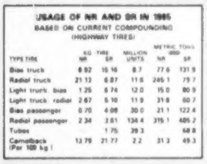

USAGE OF NR AND SR IN 1985
BASED ON CURRENT COMPOUNDING
(HIGHWAY TIRES)

TYPE TIRE	KG/TIRE NR	KG/TIRE SR	MILLION UNITS	METRIC TONS (000) NR	METRIC TONS (000) SR
Bias truck	8.92	16.16	8.7	77.6	131.9
Radial truck	21.13	6.87	11.6	245.1	79.7
Light truck, bias	1.25	6.74	12.0	15.0	80.9
Light truck, radial	2.67	5.10	11.9	31.8	60.7
Bias passenger	0.70	4.08	30.0	21.1	122.4
Radial passenger	2.34	3.01	134.4	315.1	405.2
Tubes		1.75	39.3		68.8
Camelback (Per 100 kg.)	12.79	21.77	2.2	31.3	49.3

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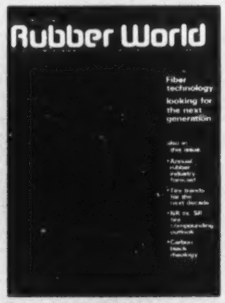

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A laser instrument at the Fibers Technical Center in Charlotte, N.C., measures the luster of individual polyester fibers of different cross sections for use in monitoring the quality of commercial products and developing new fiber types with improved properties.

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Industry forecast 1981: better, but by how much?

by David L. Schultz, Editor

"Economics" has been called the "inexact science." If this is true, then economic forecasting is an even *more* inexact science. The analysis of rubber-industry projections presented here is based on a number of sources: The World Bank, the Economic Intelligence Unit, Ltd. (EIU), the International Institute of Synthetic Rubber Producers (IISRP), the Rubber Manufacturers Association (RMA), and the U.S. Department of Commerce. While statistical data differ, most notably with the EIU, the concensus of projections call for modest growth through 1985 and a long-hoped-for recovery from a disastrous 1980. It ought to be noted, however, that these projections are all based on a general economic turnaround that may not materialize in the short-term future.

As William B. Franklin, *Business Week* editor, notes, "the disparity between the economic statistics and economic reality is getting wider, with the relatively favorable business statistics lagging behind the steady deterioration in underlying economic conditions." For example, much of the recent economic data seem to indicate that a solid business advance is under way, with more to come. But the data are not really in step with current conditions; the recovery is not as vigorous as it might seem, and it may become even less so in the months ahead. The gains appearing in many of the business statistics do not reflect the healthy glow of economic growth but the flush of inflation fever. With this *caveat* in mind, apparent statistical disparities will be self-explanatory.

The next 10 years

During the next ten years the pattern of growth of world demand for rubber will continue to be shaped by the automotive industry. But the tire business has been buffeted simultaneously by a number of factors including rapid cost increases for petrochemicals, sluggish growth resulting from increased tire life and minimal long-term prospects in domestic auto output, substantial imports of tires and finally, a cyclical downturn in the overall economy. As a result, for most major tire manufacturers, earnings per share declined during the period from July 1979 to June 1980.

During the past five years, more than 20 tire plants have closed, leaving an estimated 48 plants currently in operation. Most of these closures were of old plants that produced bias-ply tires, which have been a declining market sector. Passenger car, truck and bus tires account for 85% of the total value of tire industry shipments. The remainder includes several smaller special markets such as bicycle, motorcycle, farm tractor and implement tires, aircraft and industrial tires. Because of the state of the farm economy in 1980, farm tire shipments declined 22%; industrial tires were off 15%; and aircraft tire shipments remained unchanged.

In the area of non-tire rubber demand, growth in virtually all consuming areas is expected. Thus, overall world demand for rubber is projected to grow an average of 5.5% per year through 1990 — approximately 1% below the historical rate. Future growth in elastomer demand is anticipated to decrease more in developed and developing countries. In developed countries, rubber demand is forecast to grow 4.4% per year, compared to an annual historical rate of approximately 6%.

World output of natural rubber is expected to grow

World Elastomer Balance of Supply and Demand
Actual Averages, Projected, and Growth Rates, 1955 to 1990, Selected Years

	Actual averages (thousands of metric tons)				Projected (thousands of metric tons)		Growth rates (annual percentage)		
Item	1955-57	1966-68	1972-74	1975-77	1985	1990	1976-85	1985-90	1976-90
Production of elastomers									
Synthetic rubber	1,650	4,496	7,366	7,737	13,355	17,365	6.3	5.4	5.9
Natural rubber	1,935	2,533	3,357	3,493	5,245	6,135	4.6	3.2	4.1
Total	3,585	7,029	10,723	11,230	18,600	23,500	5.8	4.8	5.4
Consumption of elastomers									
Synthetic rubber	1,616	4,425	7,251	7,792	13.355	17,365	6.2	5.4	5.9
Natural rubber	1,902	2,619	3,384	3,536	5.245	6,135	4.5	3.2	4.0
Total	3,518	7,044	10,635	11,328	18,600	23,500	5.7	4.8	5.4
Consumption of natural rubber									
Developed countries	1,498	1,669	2,113	2,128	3,240	3,795	4.8	3.2	4.2
Developing countries	184	345	564	703	1,050	1,300	4.6	4.4	4.5
Centrally planned economies	220	611	707	705	950	1,040	3.4	1.8	2.8
Total	1,902	2,625	3,384	3,536	5,240	6,135	4.5	3.2	4.0
				(percent)					
Natural rubber market share									
World	64.1	37.2	31.8	31.2	28.2	26.1	—	—	—
World, excluding centrally planned economies	69.1	36.4	32.4	33.6	32.2	30.8	—	—	—

— Not applicable
Source: Actual data, International Rubber Study Group.

World Elastomer Demand
Actual Averages, Projected, and Growth Rates, 1956 to 1990, Selected Years

Economic region	Actual averages (thousands of metric tons)			Projected (thousands of metric tons)		Growth rates (annual percentage)			
	1965-67	1972-74	1976-77	1985	1990	1956-73	1976-85	1985-90	1976-90
Developed countries[a] — I	2,640	7,121	7,084	[illegible]	13,000	6.0	4.9	3.6	[illegible].4
— II				[illegible]	12,500				
Developing countries	207	1,147	1,339	2,800	4,000	10.6	8.6	7.4	8.1
Centrally planned economies	673	2,367	2,883	5,300	7,000	7.7	7.0	5.7	6.5
World total — I	3,520	10,635	11,327	19,000	24,000	6.7	5.9	4.8	5.5
— II				18,600	2[illegible],500		5.7	4.6	5.4

a. Alternative I refers to projections based on income elasticity; alternative II refers to projections derived from end uses.
Source: Actual data, International Rubber Study Group.

approximately 4% per year through 1990, which is slightly over 1% per year above the historical rate. However, the market share of natural rubber is likely to continue to decline during the next fifteen years as a result of inadequate supply. The world market share of natural rubber is projected to fall from 30% in 1977, to 28% in 1985, and to 26% in 1990.

From 1948 to 1973, total world consumption of rubber increased steadily at an average rate of 6.3% per year. This growth followed closely the growth of world industrial production, particularly in industrialized countries. The recovery of industrial production in general after the end of World War II created a strong demand for elastomers and propelled the world rubber economy into a period of rapid and sustained growth.

The latest statistics on rubber consumption, however, indicate a sharp downturn in demand as opposed to a variety of previous projections. The International Institute of Synthetic Rubber Producers (IISRP) recently released its long-term forecasts of rubber consumption during the 1980's. This report shows a 1.4% average annual growth rate for synthetic rubber from 1979 to 1990. Total rubber (synthetic plus natural) consumption matches this growth rate giving synthetic rubber 75.5% of total consumption. According to the IISRP report, during the next decade the percentage of total rubber going into tires and tire products will decrease from 63.1% to 61.8%. The recession and large numbers of imported automobiles, the report says, may cause rubber consumption in 1980 to decline 16% from 1979. Longer-wearing radial tires, along with smaller tires for smaller cars, contribute to the projected modest growth rate.

According to the Economist Intelligence Unit, Ltd., the latest indicators show a sharp downturn in overall rubber consumption in most Western countries during the second half of 1980, and no quick recovery is anticipated. Considering the current situation, there is no doubt that the price of synthetic rubber will continue to be under pressure and manufacturers will be forced to cut prices even further in order to keep plant capacity utilization at a reasonable level.

As a result of the deepening recession in the auto industry, the price of natural rubber has fallen sharply, averaging over 30%, even though it has recently recovered some lost ground. The price may move up marginally, but any major increase will have to wait until the overall economic situation improves, especially in the auto industry. Demand for natural and synthetic rubber has been declining significantly in a number of key markets since the beginning of 1980. In the U.S., first-quarter 1980 demand amounted to only 714,000 tons. This represented a drop of 17% compared to the same period in 1979.

Domestically, the output of synthetics was reduced considerably, dropping by an average of 10%, according to the EIU. However, the decline in output was not as great as the decline in demand and, as a result, stocks of synthetics have grown during the period. In the West European countries, the level of output continued to increase, particularly in West Germany and France. In the UK, however, the trend was easing off by last April.

Total New Rubber Consumption Forecast for U.S.A. and Canada (Thousand Metric Tons)

TYPE	1980 Estimate	1981	1985	1990
SBR-Solid	1,035	1,132	1,292	1,397
SBR-Latex	133	143	159	169
Polybutadiene	380	410	468	516
Polyisoprene	69	76	97	122
Ethylene-Propylene	131	145	184	223
Polychloroprene	115	122	137	150
Butyl	139	148	165	178
Nitrile-Solid	62	66	77	87
Nitrile-Latex	6	7	9	10
Other Synthetic	56	60	77	94
Total Synthetic	2,127	2,308	2,665	2,946
Natural Rubber	710	768	874	957
Total New Rubber	2,837	3,076	3,539	3,903
Synthetic Percent	75.0	75.0	75.3	75.5

Rubber Consumption — U.S.A. and Canada (Thousand Metric Tons)

	Estimate 1980	1981	1985	1990
U.S.A.				
Natural	624	677	772	846
Synthetic	1,946	2,119	2,449	2,706
Total	2,570	2,796	3,221	3,552
Canada				
Natural	86	91	102	111
Synthetic	181	189	216	24
Total	267	280	318	351
Grand Total	2,837	3,076	3,539	3,903

Some manufacturers of synthetics in Western Europe have misjudged the market by producing more synthetic rubber than existing markets. As a result, considerable price competition developed and selling prices have been reduced in order to balance surplus stock.

The forecasts prepared by the EIU indicate that the situation for world rubber consumption has deteriorated, and thus projections for the short-term outlook have been downgraded. For the first half of 1980, estimated consumption dropped marginally — only 1%. But the second half saw a decline of 4%. In addition, the increase in stocks for both natural and synthetic rubber are higher than originally anticipated. While major producers of synthetics have reduced their throughput, the fall in production is limited to approximately 2% for 1980. Considering the situation, synthetic rubber prices will continue under pressure; and it is unlikely that any price increase will be successful in the short term. The continued overcapacity in the industry will hamper any such attempt while increasing competition from various sources means that rubber prices will remain steady and, in some cases, be reduced.

RMA report

The Rubber Manufacturers Association (RMA), however, sees a gradual improvement in its economic outlook for the tire and rubber industry. Sales of tires, industrial rubber products, molded and extruded goods were all below 1979 levels. But according to the RMA an upturn in these markets is expected in 1981 based on a general economic recovery, particularly in the automotive sector.

Tire shipments in 1980 have been running considerably below 1979 levels, the RMA forecasts an upward turn in 1981 and 1982. Total shipments of passenger tires — original equipment and replacement — are expected to be 151 million in 1980, rising to 167 million in 1981 and to 180 million in 1982. Total shipments of truck and bus tires are expected to be 31.8 million in 1980, rising to 35.9 million in 1981 and then 39.5 million in 1982.

Forecast of
Natural Rubber Consumption by Region in 1980
('000 tons)

	1979	1980
North America	840	820
Western Europe, Africa & Middle East	1,005	1,026
Asia (including Australasia)	991	1,041
Latin America	193	207
Communist countries	725	728
Total	3,754	3,822

The market for industrial products including hose, conveyor belts and V-belts has also been soft. But it is expected to bounce back in 1981 with continued growth at least through 1985. The RMA reports that demand for all three product areas in 1980 dropped approximately 6% overall from 1979 to $1.55 billion. In 1981, the total demand for all three products is expected to rise about 4.8% to $1.63 billion. Through 1985, U.S. demand for industrial products is expected to rise steadily each year to a total of $1.88 billion.

As for the market outlook for molded, extruded and lathe-cut mechanical rubber products, the RMA sees an improving situation. It is estimated that total production of mechanical rubber goods in 1980 will be $1.705 billion. Forecasts call for a 1981 production increase to $1.078 billion. All of these predictions are based on the assumption that the worst of the general economic recession is over and that the automobile industry, in particular, is headed for better days.

Synthetic Rubber: Treads and Projections 1975-81
(in millions of current dollars except as noted)

Item	1975	1976	1977	1978	1979[2]	1980[2]	Percent change 1979-80[2]	1981[3]	Percent change 1980-81[3]
Industry (SIC 28220)									
Value of shipments[1]	1,456	1,702	1,863	1,971	2,225	2,100	—5.6	2,500	19.0
Value added	469	511	569	574	675	630	—6.7	750	19.0
Value added per production worker-hour ($)	34.49	34.28	40.15	39.61	--	--	--	--	--
Total employment (000)	9.9	10.6	10.5	10.1	10.1	10.0	—1.0	--	--
Production workers (000)	7.0	7.6	7.2	7.3	7.3	7.0	—4.1	--	--
Average hourly earnings (Dec.—$)	5.70	6.24	[illegible]	7.78	7.92	[4]8.20	[4]9.6	--	--
Year-to-year percent change in average hourly earnings (Dec.-Dec.)	9.6	9.5	8.3	15.1	7.2	[5]--	[5]--	--	--
Year-to-year percent change in industry price index (Dec.-Dec.)[6]	1.3	3.3	9.8	7.3	17.8	[5]20.8	[5]--	--	--
Capital expenditures	35	46	53	30	--	--	--	--	--
Product (SIC 28220)									
Value of shipments[7]	1,820	2,204	2,343	2,839	3,175	2,975	—6.3	3,580	20.3
Quantity shipped (unit of measure)[7]	4,500	5,450	5,850	5,850	5,900	4,800	—18.6	5,425	13.0
Year-to-year percent change in producers price index (Dec.-Dec.)[6]	—2.0	7.9	8.6	8.9	18.6	[5]20.3	[5]--	--	--
Trade									
Value of exports	267	334	325	369	601	750	24.8	--	--
Value of imports	73	97	139	158	177	177	0.0	--	--

[1] Value of all products and services sold by the hose and belting industry (SIC 2822).
[2] Estimated except for hourly earnings, price indexes, and 1979 trade data.
[3] Forecast.
[4] As of July 1980.
[5] July 1979 to July 1980. Note: Months may differ for the price and earnings indexes.
[6] December 1967 is the base period for index.
[7] Value of shipments of hose and belting produced by all industries.

Source: Bureau of the Census (industry and trade data), Bureau of Labor Statistics (hourly earnings and price indexes). Estimates and forecasts by the Bureau of Industrial

Tires and Inner Tubes: Trends and Projections 1975-81
(in millions of current dollars except as noted)

Item	1975	1976	1977	1978	1979[2]	1980[2]	Percent change 1979-80[2]	1981[3]	Percent change 1980-81[3]
Industry (SIC 3011)									
Value of shipments[1]	7,143	7,714	9,540	8,887	9,875	9,350	—5.3	11,000	17.6
Value added	3,463	3,534	4,538	4,107	4,545	4,400	—3.2	5,175	17.6
Value added per production worker-hour ($)	22.68	25.98	25.65	30.40	33.07	--	--	--	--
Total employment (000)	106	104	114	103	101	84	—16.8	88	4.8
Production workers (000)	80	79	88	81	79	62	—15.2	66	6.4
Average hourly earnings (Dec.—$)	5.70	7.15	2.33	7.82	9.04	[4]9.50	[4]12.3	--	--
Year-to-year percent change in average hourly earnings (Dec.-Dec.)	4.4	25.4	2.5	6.7	15.6	[5]--	[5]--	--	--
Year-to-year percent change in industry price index (Dec.-Dec.)[6]	5.8	13.4	—0.1	9.4	9.0	[5]15.0	[5]--	--	--
Capital expenditures	272	244	286	356	--	--	--	--	--
Product (SIC 3011)									
Value of shipments[7]	6,107	6,528	8,135	8,300	9,175	8,700	—5.2	10,235	17.6
Year-to-year percent change in producers price index (Dec.-Dec.)[6]	5.8	13.6	—1.4	5.5	24.3	[5]15.4	[5]--	--	--
Product classes									
Value of shipments[7]									
Passenger cars	3,392	3,631	4,540	4,496	5,000	4,950	—1.0	5,600	13.1
Truck and bus	1,709	1,754	2,308	2,529	2,800	2,450	—12.5	3,100	26.5
Quantity shipped (millions of tires)									
Passenger cars	167	177	195	200	184	165	—10.3	175	6.1
Truck and bus	27	31	37	44	41	32	—22.0	38	18.8
Trade									
Value of exports	306	219	309	280	353	525	48.7	--	--
Value of imports	566	889	982	1,056	1,373	1,425	3.8	--	--

[1] Value of all products and services sold by the hose and belting industry (SIC 3011).
[2] Estimated except for hourly earnings, price indexes, and 1979 trade data.
[3] Forecast.
[4] As of July 1980.
[5] July 1979 to July 1980. Note: Months may differ for the price and earnings indexes.
[6] December 1979 is the base period for index.
[7] Value of shipments of hose and belting produced by all industries.
Source: Bureau of the Census (industry and trade data), Bureau of Labor Statistics (hourly earnings and price indexes). Estimates and forecasts by the Bureau of Industrial Economics.

Hose and Belting: Trends and Projections 1975-81
(in millions of dollars except as noted)

Item	1975	1976	1977	1978	1979[2]	1980[2]	Percent change 1979-80[2]	1981[3]	Percent change 1980-81[3]
Industry (SIC 3041)									
Value of shipments[1]	1,235	1,412	1,767	1,900	1,950	1,825	—6.4	2,125	16.4
Value added	695	804	974	1,050	1,075	1,000	—7.0	1,175	17.5
Value added per production worker-hour ($)	18.94	21.11	24.11	26.40	28.13	--	--	--	--
Total employment (000)	27	30	31	32	32	27	—15.6	31	14.8
Production workers (000)	19	21	21	22	22	18	—18.2	21	16.7
Average hourly earnings (Dec.—$)	N.A.	N.A.	N.A.	5.66	6.44	[4]6.90	[4]13.1	--	--
Year-to-year percent change in average hourly earnings (Dec.-Dec.)	N.A.	N.A.	N.A.	N.A.	13.8	[5]--	[5]--	--	--
Capital expenditures	80	54	53	--	--	--	--	--	--
Product (SIC 3041)									
Value of shipments[7]	1,216	1,357	1,561	1,668	1,725	1,615	—6.4	1,870	15.8
Product classes									
Value of shipments[7]									
Flat belts	269	248	276	273	325	315	—3.1	360	14.3
V-belts	238	296	348	397	400	380	—5.0	460	21.1
Hose	703	800	922	980	975	900	—7.7	1,025	13.9
Year-to-year percent change in producers price index (Dec.-Dec.) belts and belting[6]	N.A.	N.A.	N.A.	N.A.	N.A.	[5]19.6	[5]--	--	--
Trade									
Value of exports	71	68	85	151	173	155	—10.4	--	--
Value of imports	61	67	78	111	137	137	0.0	--	--

[1] Value of all products and services sold by the hose and belting industry (SIC 3041).
[2] Estimated except for hourly earnings, price indexes, and 1979 trade data.
[3] Forecast.
[4] As of July 1980.
[5] July 1979 to July 1980. Note: Months may differ for the price and earnings indexes.
[6] December 1979 is the base period for index.
[7] Value of shipments of hose and belting produced by all industries.
Source: Bureau of the Census (industry and trade data), Bureau of Labor Statistics (hourly earnings and price indexes). Estimates and forecasts by the Bureau of Industrial Economics.

Forecast of Synthetic Rubber Consumption by Region in 1980
('000 tons)

	1979	1980
North America	2,545	2,485
Western Europe, Africa & Middle East	1,776	1,814
Asia (including Australasia)	1,256	1,319
Latin America	485	525
Communist countries	2,716	2,877
Total	8,778	9,020

Forecast of Rubber Consumption in the Western World by Product Group in 1980
('000 tons)

	1979	1980
Polycholoroprene	292	296
Butyl	402	412
Nitrile	200	198
Other synthetics	118	121
Total synthetics	6,062	6,144
Total natural	3,028	3,093
Total rubber	9,090	9,237

Source: International Institute of Synthetic Rubber Producers.

Commerce outlook: 2%

According to the U.S. Department of Commerce, the current dollar value of shipments by the rubber and plastics products industries (SIC 30) is expected to increase from $49 billion in 1980 to almost $60 billion in 1981 to constitute a rise of 17.5%. Real growth in these industries, however, is pegged at approximately 6%, reflecting long-term growth of 4%. Shipments by the rubber and rubber products industries are expected to increase 16.5% between 1980 and 1981, from $19 billion and $22 billion. Commerce views real long-term growth for rubber products as sluggish, less than 2% annually.

In sharp contrast to the EIU forecast cited above, commerce predicts that the value of shipments by the synthetic rubber industry will be about $2.5 billion in 1981, up 19% from 1980. This growth in value will represent a real growth of 13% plus price increases of 6%. The real annual growth rate to 1985 will be 1% to 2%, primarily in specialty elastomers. Specialty rubbers usually are higher priced than general-purpose rubbers, have unique characteristics, and are used in a wide variety of products. Most recent industry growth has been in selected specialty rubbers, and Commerce expects this to be the case in the future. Among the specialties, for example, thermoplastic elastomers have become a major item in the industry. Though no separate statistical data are reported for thermoplastic rubbers, Commerce notes that "production probably exceeded 100,000 tons in 1980 and could rise to 250,000 tons by 1985." Other specialties with significant growth rates include silicone rubbers and epichlorohydrin elastomers.

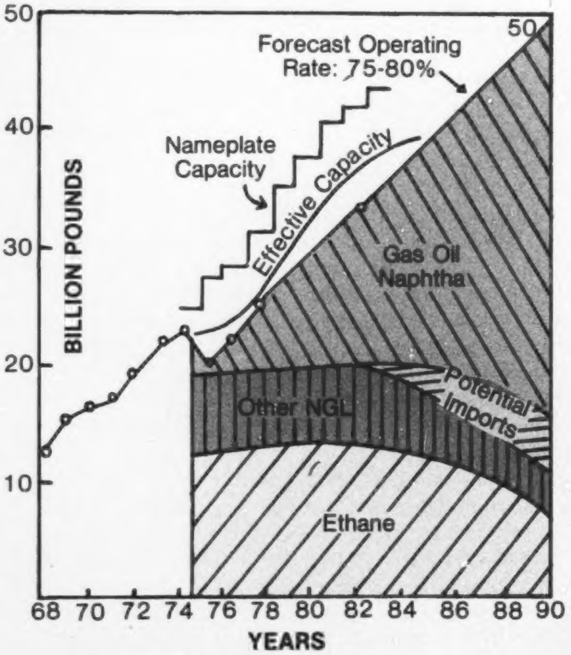
In the tire and inner tube sector, Commerce says that the value of shipments will be about $11 billion current dollars in 1981, up almost 18% from $9.4 billion in 1980.

The report cautions that "the raw statistics are highly misleading because in 1981 the industry will be recovering from extremely low output in 1980 and will be experiencing continued price increases." Physical output in 1981 should be up more than 8% from 1980 but will be substantially below previous record years. Through 1985, real long-term growth will be very slow, averaging less than 2% annually, although a cyclical surge should make 1982 and 1983 reasonably good years.

The value of hose and belting industry shipments, according to Commerce, will increase over 16% in 1981, to $2.1 billion (current dollars). Shipments declined in 1980, as expected, but the severity of the downturn, over 6%, was greater than generally anticipated. During 1981, growth should accelerate throughout the year, and final-quarter shipments are expected to be substantially above the first quarter. Commerce notes that "growth in the value of shipments in 1981 will represent price increases of almost 10%, long-term real growth of 4%, and partial cyclical recovery. Real growth should continue at a 4% annual rate to 1985."

Hose and belting have been the fastest growing segment of the generally slow-growing rubber products industries. Important markets for hose and belting are for automotive, agricultural, mining, industrial, and construction applications. Mining, particularly coal mining, is a significant market for these products and also is a potentially rapid-growth market for the future. Developing the vast coal reserves in the U.S. will require substantial additional quantities of hose and belting, especially flat belting; and this prospect is a source of long-term optimism for the industry. Other markets depend on overall economic activity, especially in transportation equipment and in construction of new plants; in short, capital investment. **RW**

US Ethylene Supply/Demand 1968/1990 (Forecast)



A BILL PUBLICATION

Rubber World

TECHNOLOGY/MARKETS/NEWS
VOLUME 183, NO. 5
FEBRUARY 1981

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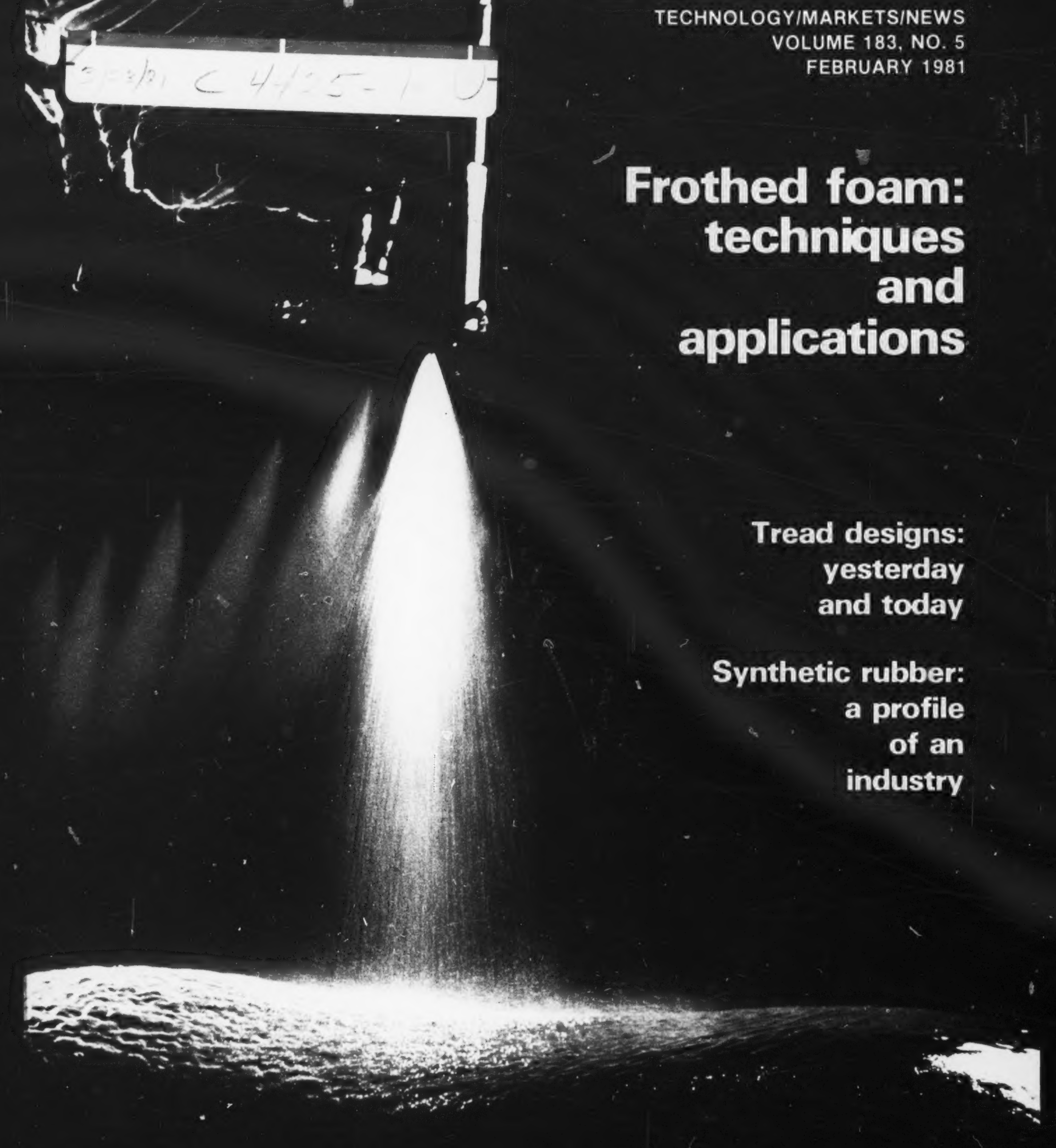

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Tread designs: yesterday and today

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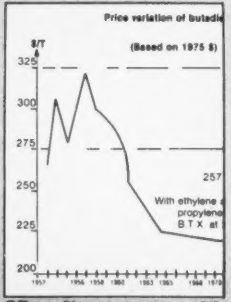

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Spray application of rigid urethane foam on substrate creates an unusual visual pattern. Photo: courtesy of Witco Chemical Corp., Isocyanate Products Div., Wilmington, Del.

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Late News

Armstrong buying controlling interest in Copolymer Rubber

Armstrong has reached an agreement in principle with Sears, Roebuck to acquire two-thirds of Sears' interest in Copolymer Rubber & Chemical. Armstrong presently owns a 50% interest in Copolymer while Sears and Gates Rubber each have 25%. The transaction between Armstrong and Sears will result in increasing Armstrong's share to 66-⅔%. Sears will receive approximately 200,000 shares of Armstrong common stock. A Sears subsidiary, Allstate Insurance, owns 168,400 shares, or 9.9% of the outstanding Armstrong common stock. Sears holdings in Armstrong will increase to over 21%. Copolymer has two plants in the Baton Rouge, LA, area where it produces synthetic rubber compounds and derivatives. Gates has indicated that it is negotiating with Sears to acquire the remaining one-third of Sears' interest in Copolymer to increase Gates' interest to 33-⅓%.

Neutrality letter of 1979 applies to Firestone's Okla. Dayton Tire plant

The United Rubber Workers has announced that organizing neutrality does apply to Firestone Tire and Rubber's Oklahoma City Dayton Tire facility. Arbitrator Edwin R. Teple ruled that the neutrality letter of July 14, 1979 applies to that plant. According to URW International President Peter Bommarito, this is a major victory for the union. "The only tragedy is that it was apparent to us that the neutrality letter of 1979 did apply," he said. "It's a shame that this didn't take effect until now." Firestone had adopted a "no strike/me too" position in the 1979 negotiations. But after BFGoodrich set the pattern, which included a URW-negotiated organizing neutrality letter, it was the URW's position that this applied to Dayton Tire in Oklahoma as well.

The neutrality letter applies to unorganized tire facilities. Under it, Firestone agreed to "neither discourage nor encourage the union efforts to organize these employees, but will observe a posture of strict neutrality in these matters." It also said, The union would "conduct itself in such organizing campaigns in a constructive manner which does not misrepresent to employees the facts and circumstances surrounding their employment."

Bommarito said, "It was our intention to begin an active campaign in Oklahoma City sometime in January regardless of the outcome of this case. We are now delighted to be able to do so under neutrality." Since 1970, the URW has conducted a number of close NLRB elections, including one with a tie vote, at this tire plant. (Tie votes count as wins for the company.) On December 19, when the neutrality was supposed to have been in effect, the vote was URW 557, the company 588.

Commerce Dept. predicts real growth of 6% for rubber industry

Shipments of rubber and rubber products are expected to increase 16% this year to $22 billion the Commerce Department forecast. Adjusted for inflation, the gain would be 6% compared with a drop of 15% in 1980. Commerce's Bureau of Industrial Economics said the rubber industry should grow at 1% to 2% in real terms through 1985. The BIE said "the expected growth in car sales, increased use of hose to transport petroleum and natural gas, and development of U.S. coal reserves, which will require substantial quantities of hose and belting, offer long term optimism for the industry."

General Tire profits decline; T.F. O'Neill resigns board position

Slumping automobile production and unfavorable economic conditions were cited by General Tire as major causes of a 49% decline in net income for 1980. General posted sales of $2.2 billion with a new income of $40.7 million. The company earned $80.1 million in 1979 on sales of $2.29 billion. Fourth quarter figures however, showed an income increase of 101% over the previous year on a sales increase of 4.1%. The company also announced that board chairman T.F. O'Neill would not run for re-election. The board anticipates that M.G. O'Neill, president of General Tire, will assume the additional duties. T.F. O'Neill will stand for re-election as a director and expects to remain as chairman and CEO of RKO General.

RMA MONTHLY TIRE REPORT (Through October)

Passenger Tires	Cum. 1980	Cum. 1979	Tractor Implement Tires		
Shipments			Shipments		
Original Equipment	29,685,919	42,366,040	Original Equipment	1,361,965	1,832,189
Replacement	91,618,670	106,902,285	Replacement	2,233,039	2,760,993
Export	3,427,790	3,251,382	Export	183,081	168,669
Total	124,732,379	152,519,707	Total	3,778,085	4,761,851
Production	109,331,899	146,322,620	Production	3,582,143	4,760,339
Truck & Bus			Tread Rubber		
Shipments			(Figures in 000 lbs.)		
Original Equipment	4,458,315	8,798,028	Shipments		
Replacement	20,386,677	24,644,167	Domestic	346,464	377,597
Export	1,254,541	931,205	Export	38,952	33,960
Total	26,099,533	34,373,400	Total	385,416	411,557
Production	23,723,607	33,544,869	Production	388,039	415,166

Synthetic rubber: profile of an industry

by David L. Schultz, Editor

Between 1945 and 1973, synthetic rubber continued to be produced in increasing quantities to gain a predominant position in the world market. Integration by petrochemical producers and tire manufacturers became a prevalent characteristic of the production process. Consumption of rubber increased dramatically during the period. The extremely rapid growth of motor vehicle use in Western Europe and Japan, coupled with the continuous expansion of automotive production in the U.S. created a strong and steady demand for elastomers. Non-automotive elastomer demand also increased rapidly: between 1948 and 1973, total consumption of elastomers increased 6.3% per year.

The oil crisis and subsequent sharp rise in crude oil prices beginning in 1973, however, severely impacted the synthetic rubber industry — an industry which depends so heavily on petrochemical feedstocks. In 1978-1979, the price of crude oil again increased sharply in real terms, bringing the cumulative increase since 1973 to more than 400%.

These crude oil price increases have affected production costs of SR more than NR. The production cost of SR depends heavily (as much as 70% of the total) on the costs of chemical feedstocks and energy inputs such as steam and electricity. Between 1973 and 1975, the cost of the basic chemical monomers used in synthetic rubber production — styrene, butadiene and isoprene — and of other chemical and energy inputs more than doubled.

Lower demand

Changes in consumer preferences accompanied by significant technological innovations are contributing factors in a slowdown of world elastomer demand. Most recent estimates peg world demand for elastomers at an average growth rate of 5% to 5.5% per year to 1990 — approximately 1% below the historical rate. But even this estimate may prove to be overoptimistic. The U.S. Department of Commerce, for example, sees a real annual growth rate in the synthetic rubber industry of 1% to 2% to 1985 (*RW*, Jan. 1981, p. 23). It would appear that the industry is facing in particular greater uncertainties concerning the availability and pricing of chemical feedstocks in addition to mounting pressure over environmental and health issues.

Cost and availability of feedstocks are key worries in the synthetic rubber industry. For example, just as industry analysts and producers forecast, ethylene prices for the first quarter of 1981 have settled to a high 24.5¢ per pound. And industry sources agree that the new, higher price will hold through the remainder of the quarter. Several ethylene analysts have stated that they will not risk forecasting a price for olefins beyond the first quarter, but agree in anticipating a continued escalation in ethylene prices as a result of the rising costs of all feedstocks.

Another concern is that worsening business conditions in the U.S. will result in substantial discounting which will bring additional instability and uncertainty to an already iffy situation. While prices have risen strongly, there is some question as to the durability and net financial effect of the increases. Most officially-announced increases are in the 5% to 15% range with a cluster from 8% to 10%. But world oil prices have already outstripped these percentages, and further increases are anticipated for the spring.

SR types

Seven major types of SR dominate the market in terms of tonnage, accounting for approximately 98% of all SR and 66% of all rubber consumed. Styrene-butadiene (SBR), polybutadiene (BR) and polyisoprene (IR) are commonly classified as the general-purpose type SR. Ethylene-propylene rubbers (EPM/EPDM), polychloroprene rubber (CR), nitrile rubber (NBR) and butyl rubber (IIR) are generally classified as specialty rubbers.

Historically, these seven types of

World Rubber Consumption, by Kind of Rubber, 1977

Kind of rubber	Thousands of metric tons	Percentage of synthetic rubber	Percentage of total rubber
Synthetic rubber			
Styrene-butadiene (SBR)	3,328	58.3	38.3
Polybutadiene (BR)	895	15.7	10.3
Polyisoprene (IR)	208	3.6	2.4
Ethylene-propylene (EPM-EPDM)	290	5.1	3.3
Polychloroprene (CR)	318	5.6	3.7
Butyl (IIR)	386	6.8	4.4
Nitrile (NBR)	190	3.3	2.2
Other synthetic	91	1.6	1.1
Total	5,706	100.0	65.7
Natural rubber	2,984	—	34.3
Total rubber	8,690	—	100.0

Note: Excluding centrally planned economies
— Not applicable
Sources: International Institute of Synthetic Rubber Producers (IISRP), private communication; and International Rubber Study Group, *Statistical Bulletin*.

Rubber growth rates (%/yr)

	US		W. Eur		Far East	
	80/85	85/90	80/85	85/90	80/85	85/90
SBR	2.5	2.0	1.5	1.0	5.0	5.0
BR	3.5	2.0	3.5	2.5	5.5	4.5
NBR	3.0	2.0	2.5	3.0	4.0	5.0
CR	2.5	2.0	1.5	2.0	2.5	2.5
Butadiene	3.0	2.5	2.5	2.0	5.0	5.0

Source: IISRP

US synthetic rubber production, 1980 (%)

SBR	59.0
Isoprene	3.0
Nitrile	3.3
Neoprene	5.2
Butyl	5.5
Ethylene-propylene	6.0
Polybutadiene	18.0

World synthetic rubber production (000 m tons)

	1978	%
US	2,473.4	28.4
Japan	1,028.9	11.8
France	491.5	5.6
W. Germany	407.0	4.7
UK	293.7	3.4
Italy	250.0	2.9
Canada	248.3	2.8
Netherlands	222.8	2.5
Others	3,304.4	37.9
Total	8,720.0	100.0

Source: Syndicat National du Caoutchouc et des Plastiques (France)

SR can be divided into two main classes: first-generation synthetics (styrene-butadiene, polychloroprene, butyl and nitrile) developed before WW II and second-generation or stereoregular rubbers (polybutadiene, polyisoprene and ethylene-propylene) developed in the 1950s.

In recent years, however, production of SR has declined. For example, total U.S. production of SR in 1978 amounted to 5,761 million pounds, a decrease of 0.9% from that produced in 1977. Total sales of elastomers in 1978 amounted to 3,640 million pounds, a decrease of 12.9%.[1]

In terms of tonnage, styrene-butadiene rubber (SBR) is the single most important type of rubber in the world. It represents 38% of total rubber consumption outside the centrally-planned economies. Its share in total synthetic rubber consumption is even higher, about 58%. Worldwide, more than 60% of all SBR is consumed in tires. Other uses include footwear, conveyor belts, cable insulation, hose, battery containers and adhesives. But here, as with numerous other sectors of the synthetic industry, the monomer supply is expected to grow tight through 1985. Demand and growth projections for styrene — 6,900 million pounds (1980); 7,000 million pounds (1981); and 8,500 million pounds (1985) coupled with a growth rate of a projected 4.3% per year through 1985 — if they are to prove accurate, means that the industry will need a new "world-scale" plant every three years as the decade progresses, an unlikely eventuality.

Consequently, production of SBR is expected to level off or decline. In addition to increasingly-tight feedstock supplies, another problem is the buildup of overseas capacity and the consequent loss of export markets. Whereas exports accounted for 15.2% of all U.S. production of SBR in 1963, their share fell to 6.0% in 1978.

Polybutadiene rubber (BR), the second major SR type, accounted in 1977 for 15.7% of total SR consumption outside the centrally-planned economies and 10.3% of total rubber consumption. One characteristic of BR is that it is seldom used alone. Normally it is blended with SBR or NR. Until the mid-1960's, BR was priced above SBR-1500. But from the mid-1960's onwards, BR prices have been approximating those of SBR.

> ***"Technological innovations in synthetic rubber production seem to have run much of their course."***

Polyisoprene (IR) is the closest synthetic to NR. But despite its excellent properties and high manufacturers' expectations of its market potential, IR has found it difficult to compete with NR on a relative price basis. IR is costly to produce since both the derivation of the isoprene monomer and the polymerization process are technically more complex and costly than those of SBR. Market penetration of IR has been slow over the past ten years. For example, in 1977, IR accounted for only 3.6% of all SR and 2.4% of all rubber consumed outside the centrally-planned economies.

When ethylene-propylene rubbers (EPM and EPDM) were introduced a decade ago, they were widely touted as another SBR or general-purpose rubber. However, they have not yet been accepted in tire applications in any great quantity. The low cost of the basic monomers, the ability of EPM to accept high loadings of oil, and its processing ease were thought to be strong assets. But EPM was difficult to vulcanize; and the solution to this problem — the addition of diene, a costly material — counteracted much of the initial relative cost advantage and prevented the modified EPM from entering the tire market. EPDM is now used mostly in automotive parts other than tires, where resistance to ozone and weather is required.

(continued on page 32)

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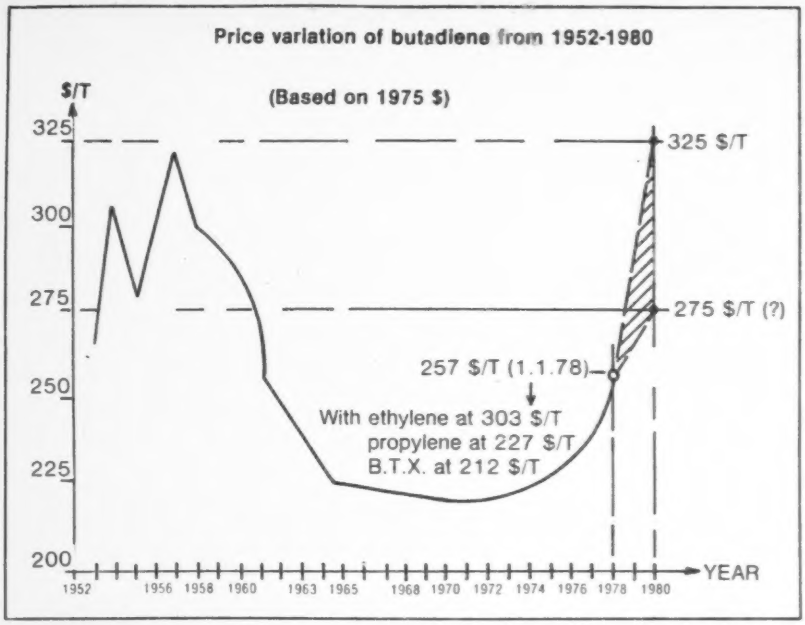
[1] U.S. International Trade Commission, *Synthetic Organic Chemicals*, 1979, USITC Publication 1001, Washington, D.C.



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Polychloroprene (CR), butyl rubber (IIR) and nitrile rubber (NBR) are the three remaining important types of SR from the standpoint of world consumption. All are expensive on a relative basis and are used only in products which require their special technical properties. Other SR's include a large number of specialty rubbers which meet specific needs of particular manufactured products. There are approximately 170 distinct kinds of specialty rubbers which can be classified as castable elastomers such as urethane, silicones and polysulfides; thermoplastic rubbers; and powdered elastomers.

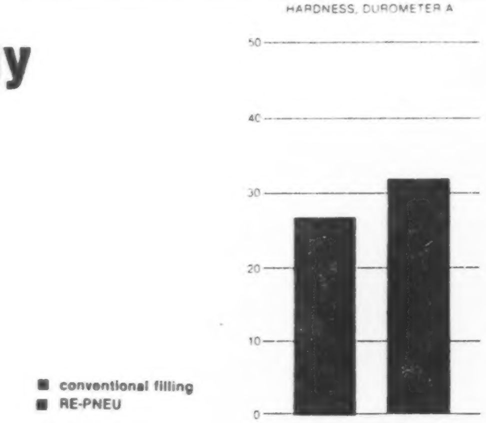
Maturing industry?

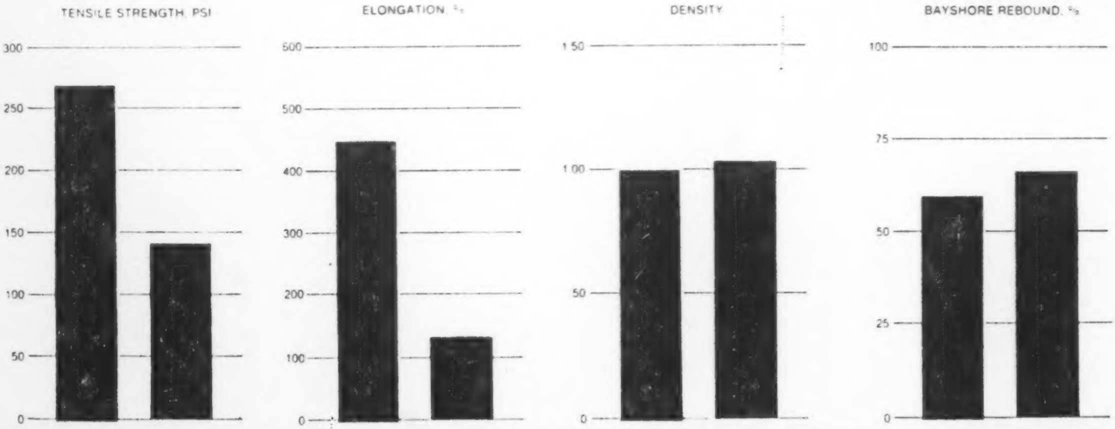
According to an extensive report compiled by the World Bank, technological innovations in synthetic rubber production, as well as in economies of scale, seem to have run much of their course. Their future effect on the cost and price of the traditional kinds of SR is likely to be much less strong than in the 1950's and 1960's. "After twenty-five years of unrestrained expansion," the report notes, "the synthetic rubber industry is reaching a stage where emphasis is likely to be put on rationalization, consolidation and more planned growth."

Apart from the economic constraint to further rapid growth posed by high and still-rising real energy costs, the synthetic rubber industry — as noted above — will have to face uncertainties concerning the availability and price of chemical feedstocks, mounting pressures over environmental issues related to the production of chemicals, and some critical questions concerning the potential health hazards of prolonged exposure of workers to certain basic chemicals.

Tire-filling technology

The December issue of RW contained a chart comparing performance characteristics of several tire-filling compounds. In that illustration, the color codes were inadvertently reversed. Here are the corrected performance characteristics of RE-PNEU as compared to conventional tire-fill products. — Ed.





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Rubber World

TECHNOLOGY/MARKETS/NEWS
VOLUME 183, NO. 6
MARCH 1981

Reinforced elastomers: Fibers in V-belt compounds

How plasticizers affect low temperature properties

Compounding ingredients price list

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CONGRSS INFOR SVC INC
ATTN J.MCMALLY
4520 EAST-WEST HIGHWAY
WASHINGTON DC 20014**

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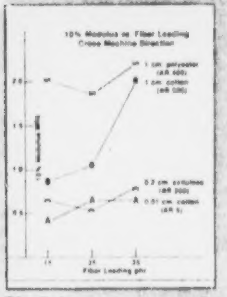

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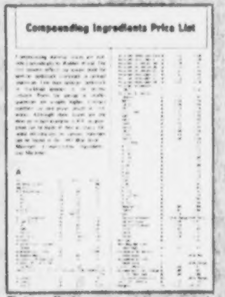

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Cover

To withstand dynamic forces, anisotropic composites of rubber reinforced with fiber have been developed that exhibit high modulus in the transverse direction and low modulus coupled with high flexibility in the axial direction. Cover courtesy of Dayco Corp., Dayton, Ohio.

ABP

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Business Briefs

Acquisitions, expansions

Ohio Rubber's Orthane Division has completed expansion of its Denton, TX manufacturing facility. The addition will increase manufacturing space by 75% and house the casting operation and provide warehouse space. Expanded injection molding operations will occupy plant space formerly taken by casting.

The resins department of **Ciba-Geigy** increased capacity of epoxy cresol novolac (ECN) resins at its plants in Toms River, NJ.

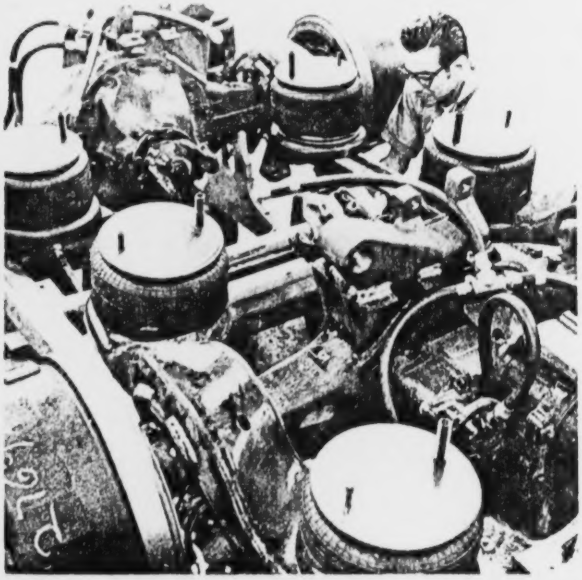
Arco Chemical purchased the **Sartomer Division** of Lekssi, Inc. Sale includes all the physical assets located on Sartomer's West Chester PA facility as well as patents trademarks, customer lists and formulations.

Construction is expected to take up to three years for a proposed $200 million polyethylene resin plant by Alberta (Can.) Energy Co. and **DuPont Canada**. Start-up capacity is expected to be 500 million pounds a year. The plant would be in Edmonton.

Carlisle Tire formed two operating divisions. One will be responsible for tire, tube and hose products with the second handling construction and roofing products.

Production capacity will increase by more than 10% when **PPG Industries** finishes a $20 million expansion at its Shelby, NC, fiber glass plant. Upon completion in the spring of 1982, annual capacity will be 275 million pounds annually of continuous filament fiber glass.

Firestone sold its wire and cable division to **Tokyo Rope Co.** and two other Japanese companies for around $10 million. The Japanese plan to increase capacity at the Danville, TN, plant from 440 tons monthly of steel cord to between 500 tons and 1,000 tons.



A TRUCK INDUSTRY push to reduce driver fatigue has resulted in manufacturers fitting an increasing number of heavy duty trucks with air spring suspension systems as shown here. Goodyear, a major supplier of original equipment air springs, is now offering Super-Cushion air springs to the truck replacement market.

RMA MONTHLY TIRE REPORT

(Through November)

	Cum. 1980	Cum. 1979
Passenger Tires		
Shipments		
Original Equipment	32,819,851	45,894,037
Replacement	99,107,765	114,971,111
Export	3,747,810	3,581,259
Total	135,475,226	164,246,407
Production	119,930,572	158,080,554
Truck & Bus		
Shipments		
Original Equipment	4,899,911	9,397,996
Replacement	22,396,441	26,785,667
Export	1,365,635	1,053,748
Total	28,661,987	37,237,411
Production	25,986,089	35,266,672
Tractor Implement Tires		
Shipments		
Original Equipment	1,472,820	1,980,428
Replacement	2,388,866	2,942,965
Export	192,655	184,541
Total	4,054,341	5,107,934
Production	3,882,972	5,163,018
Tread Rubber		
(Figures in 000 lbs.)		
Shipments		
Domestic	382,365	417,946
Export	42,082	37,156
Total	424,447	455,102
Production	428,302	460,389

Drew Chemical has sold its specialty chemicals business in Brazil to a new company, **Drew Produtos Quimicos.**

Goodyear Canada is undergoing $16 million expansion program at its Toronto factory. Part of the four story facility will convert from bias tire to radial tire production.

Radiation Dynamics will install a 3 million electron volt accelerator in the company's Melvill, NY, facility. This will double RDI's capacity to process wire, cable and plastic tubing. RDI is also planning to install a 4.5 million electron volt accelerator in a processing service center to be located in New Jersey.

Management members of **Rubbermaid's** Specialty Products division in LaGrange, GA, are potential buyers for that unit which manufactures automotive accessory items.

Armak completed construction of a pilot plant in McCook, IL, for the production of two new raw materials for polyurethane which are produced using a non-phosgene process.

Glenro completed its Heat Process Applications Lab to conduct feasibility checks on heat process equipment and to determine effects of heat processes on a product.

Arco Chemical postponed construction of its previously announced 150 million pound per year polymeric isocyanates plant in Channelview, TX.

Contracts, licenses

Burgess Pigments has expanded the area that **Walsh Associates** represents for them. Walsh will now include Denver in the area it represents for Burgess aluminum silicate pigments.

Crompton & Knowles appointed **New England Resins and Pigments** as a distributor for color paste dispersion and microfine products in New England and upper New York state.

U.S. & World Rubber News

Chemical industry survey indicates good year ahead

WASHINGTON — Despite uncertainties in the national economy, the chemical industry has good expectations for 1981, a survey by the Chemical Manufacturers Association reveals.

Robert Roland, president of CMA, said the level of investment planned for this year by the companies demonstrates a basic belief the U.S. economy will rebound and that new production capacity will be needed. Roland cautioned, however, that the survey reflects views before the large increases in the prime rate and dollar values were not corrected for the high level of inflation.

The survey predicts record shipments of $186 billion this year, an increase of 16% over the expected 1980 level of $160.6 billion. This would exceed the annual growth rate during the 1970-1980 period of 12.7%.

Expected net income is predicted to increase 18% to $12.7 billion. This would be a significant improvement over the long-term growth rate of 11.6%.

Chemical industry capital investment in the U.S. is expected to increase 20%, or an outlay of $11.5 billion. Capital investment by U.S. firms abroad is expected to grow at a rate of 30%.

Respondents in the survey felt that inflation is the major nonregulatory problem they face. Helping to fuel the inflationary spiral will be a significant growth rate in costs. Raw material costs are expected to increase 14%, fuel and energy costs should be up 16% and labor and construction material costs are seen increasing 12%. Feedstock availability, cost/profit squeeze and productivity were other non-regulatory problems cited.

The major regulatory problems will be complying with the Resource Conservation and Recovery Act and the Toxic Substances Control Act.

Employment in the industry is expected to increase 3% this year compared to no increase last year. Capacity utilization will remain around 81%, matching the rate of recent years and higher than the 1980 level of 78%.

According to the survey, crude oil and natural gas account for about 85% of the industry's raw material and energy needs. That amounts to about 7% of total U.S. energy consumption. Almost 6.5% of the country's oil usage and 3% of its gas are made into chemical products.

Exports are expected to continue

Indices of Chemicals and Allied Products Industries 1970 - 1980

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980(P)	1980 over 1979	5 Year growth rate*	10 Year growth rate*
Total Shipments (billion $)	48.5	50.9	57.4	65.0	83.7	89.7	104.1	113.9	126.4	149.2	160.6	7.64	12.35	12.72
Production Index (1967=100)	120.4	125.9	143.6	154.5	159.4	147.2	169.3	180.7	197.4	210.5	205.5	-2.38	6.90	5.49
Corporation Sales (billion $)	58.1	62.1	70.4	83.6	[a]84.9	88.2	101.8	112.4	126.0	142.8	157.4	10.22	12.28	[a]
Capitol Expenditures New Plant & Equipment (billion $)	3.44	3.44	3.45	4.46	5.69	6.25	6.68	6.83	7.10	8.40	9.73	15.83	9.26	10.96
Operating Rate (%)	82	81	84	88	85	74	80	78	80	83	80	-	-	-
Producer Price Index	102.2	104.1	104.2	110.0	146.8	181.3	187.2	192.8	198.8	222.3(R)	261.7	19.28	7.62	9.86
Total Employment (thousands)	1049	1010	1008	1033	1057	1013	1034	1057	1096	1113	1114	0.09	1.92	0.6
Average Weekly Wage Production Workers ($)	154	164	176	188	202	220	245	266	294	318	344	8.2	9.35	8.37
Funds for Research and Development (billion $)	1.59	1.64	1.71	1.86	2.16	2.41	2.75	2.97	3.5	3.85#R	4.24#R	10.1	12.0	10.3
Exports (million $)	3826	3836	4133	5749	8819	8691	9959	10312	12618	17306	21 246	22.8	19.6	18.7
Imports (million $)	1450	1612	2015	2463	4018	3696	4772	4970	6427	7485	9003	20.3	19.5	20.0

Sources:
U.S. Department of Commerce, Bureau of the Census
Federal Reserve Board
Federal Trade Commission
U.S. Department of Commerce, Bureau of Economic Analysis
U.S. Department of Labor, Bureau of Labor Statistics
National Science Foundation (Industry generated funds only--excludes Government sponsored)

Notes: (P) Preliminary
(R) Revised

[a] New basis beginning in 1974. Not comparable for previous years.
#Estimated by CMA
*Compounded annually

increasing, but at a slower rate. The decontrol of gas and oil and anti-dumping actions by the European Economic Community will slow-down imports.

Expenditures for research and development are expected to rise 12% at an outlay of $4.75 billion.

The survey respondents indicated that capital outlays necessary to comply with environmental regulations would show only a slight increase this year because the retrofiting of existing older plants with pollution abatement equipment is nearing completion.

$720 million sales for hose, belting

LINCOLN, NB — Retail sales of replacement hose and belts for cars is expected to rise to an unprecedented $720 million this year, Goodyear predicts. Paul Foley, Goodyear's manager of automotive replacement products, says the market should increase between 3% and 7% annually the next five years.

Foley said the aftermarket growth rate for belts and hose is greater than the majority of replacement automotive replacement parts. He attributes the increase to several factors, including the rise in car registrations to 125 million in 1980 and the increased average automobile life to more than 6½ years, with more than 25% over 10 years old.

Rising under-the-hood temperatures, due to smaller, more crowded engine compartments, also have placed a greater demand on replacement belts and hose. "Today's belts are squeezed into tighter spaces on smaller pulleys and must carry higher horsepower loads," Foley said.

"Belts and hose are more durable but the operating temperatures of modern engines are higher with the result that under-the-hood conditions are more severe than ever before," he added.

Additionally, the growth in retail sales can be traced to an enhanced availability of replacement belts and hose for imported cars, an increase in the number of under-the-hood rubber products per car and more traffic-building promotional campaigns.

Foley said that since belts and hose sales will exceed most other aftermarket lines, inventories will have to be monitored more carefully to insure product availability.

Moderate growth predicted for W. Europe rubber industry

HOUSTON, TX — In its ten-year forecast of rubber consumption in Western Europe, the International Institute of Synthetic Rubber Producers, predicted a moderate annual growth of 1.8%. In making the announcement, Milton Rhoad, managing director of the IISRP, cited the deepening recession as the major contributor to the drop in total rubber consumption between 1979 and 1980. He said the turnaround into a period of modest growth matches the general economic outlook for the region.

According to the forecast, consumption of synthetic rubber should rise slightly in overall percentage of total rubber from 64.2% in 1980 to 65.7% in 1990.

The sharpest rises in consumption should occur in the newer polymers and the specialty polymers. Ethylene-propylene, polybutadiene, polyisoprene and nitrile-solid also show strong gains. E-P is projected to reach 175 thousand metric tons by 1990, up from 120 tmt in 1980. Polybutadiene will increase 95 tmt to 330 tmt, polyisoprene is expected to increase 35 tmt to 125 tmt and nitrile-solid to 80 tmt from 60 tmt.

SBR-solid, the largest volume type synthetic will increase to 811 tmt from 660 tmt in 1980.

The forecast was compiled by the IISRP's European section statistical committee.

Total new rubber consumption forecast
West Europe
(thousand metric tons)

TYPE	1980 Estimate	1981	1985	1990
SBR-Solid	660	670	746	811
SBR-Latex	125	125	145	155
Polybutadiene	235	240	280	330
Polyisoprene	90	95	110	125
Ethylene-Propylene	120	130	155	175
Polychloroprene	88	89	99	110
Butyl	120	122	132	145
Nitrile-Solid	60	62	73	80
Nitrile-Latex	14	15	16	19
Other Synthetic	42	44	51	65
TOTAL SYNTHETIC	1,554	1,592	1,807	2,015
Natural Rubber	865	865	950	1,050
TOTAL NEW RUBBER	2,419	2,457	2,757	3,065
Synthetic Percent	64.2	65.0	65.5	65.7

Additive usage will triple by 1995

CLEVELAND, OH — The U.S. market for plastic additives will exceed 20 billion pounds in 1995 a report by Predicasts says. The Cleveland based market research firm indicates continued resin price increases will boost consumption of the fillers and reinforcing fibers used to extend and strengthen resins. In addition, growing use will be made of processing aids added to polymers to reduce manufacturing costs.

The study says consumer preferences for better color rendition, improved flame retardancy and plastic comfort items will also benefit the market. Predicasts notes that emphasis is shifting from additives used to produce a plastic compound for a specific end use (blowing agents to produce foamed plastics) to those used to lower overall costs.

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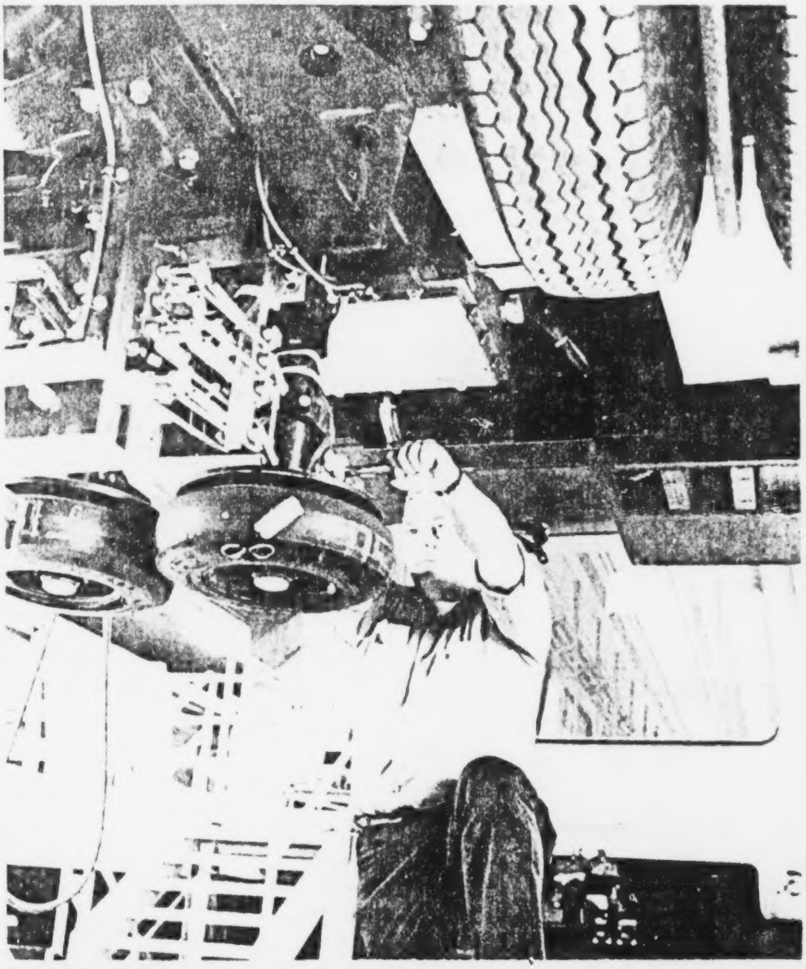
Plastic additives consumption by type

ITEM	1979	1995	% Annual Projected Growth
Plastics Consumption (bil lb)	34.9	111.7	7.5
additives/plastics	.19	.18	---
Total Additives Cons (mil lb)	6777	20634	7.2
Fillers	3385	11840	8.1
Plasticizers	1670	2650	2.9
Colorants	337	1065	7.5
Reinforcing Fibers	644	2400	8.6
Blowing Agents	181	455	5.9
Stabilizers	133	431	7.6
Processing Aids	131	488	8.6
Flame Retardants	202	895	9.7
Other Additives	94	410	9.6

Source: Predicasts Research Group; Cleveland, Ohio

Fillers, which accounted for 50% of total 1979 additives consumption, will garner 57% market share in 1995, almost 12 billion pounds. Flame retardants, reinforcing fibers and processing aids are also expected to improve their market position, while plasticizers used to render PVC flexible will decline from 25% to 13% of the total market.



MAKING MINOR adjustments to this people mover system at Atlanta's Hartsfield airport. Each of the vehicles uses eight Firestone radial truck tires and eight urethane foam-filled guide tires. The system consists of 17 electric-powered vehicles capable of carrying up to 80 passengers. Traveling through private tunnels eliminates chance of flat caused by road debris and the urethane tires which lock onto a guidebeam are flat proof.

A BILL PUBLICATION

Rubber World

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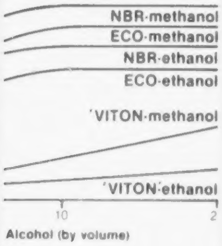

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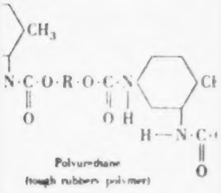

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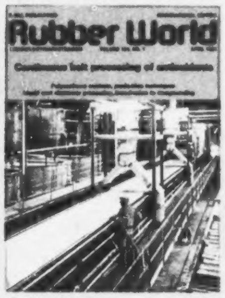

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Cover

Tough to handle supercooling antioxidants can now be handled in a continuous, automatic process. Cover courtesy of Sandvik Conveyor, Inc., Allendale, N.J.

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Rubber World Stock

		PRICE							TREND TO MARKET				EARNINGS/SHARE				
									Price Trend (% per day)		Volume Trend (% per day)			Latest 12 Months vs Preceding 12 Months Change			
					Change		52 Week										
Name	Symbol	High	Low	Close	Amt	Pct	High	Low	Last 30 Days	Last 5 Days	Last 30 Days	Last 5 Days	Last Fiscal Year	Amt	Pct	5-Year Annual Growth Rate	Profit Margin
		$	$	$	$	%	$	$	%	%	%	%	$	$	%	%	%
Tires and Inner Tubes																	
Aegis Corp	AO	2.63	2.00	2.38	.38	18.75	2.75	1.38	.47	-1.73	5.89	-43.82	.18	-.09 F	-33.3	3.0	1.3
Alliance Tire	ATRA	9.38	8.25	8.25	-1.25	-13.16	11.13	5.91	.18	-2.05	-7.28	85.00	1.45	1.45 N	149.4	20.0	5.6
Armstrong Rub	ARM	32.75	25.50	31.25	5.75	22.55	32.75	14.38	.78	1.34	2.46	1.34	-10.17	-13.77 Q	-303.9	-41.0	-4.1
Bandag Inc	BDG	25.00	22.25	23.75	1.38	6.15	25.25	14.25	.43	-1.38	-2.04	-34.96	2.27	.28 F	14.0	9.0	8.3
Cooper Tire	CTB	42.00	34.50	37.63	3.38	9.85	42.00	9.63	.78	.70	-3.57	-14.46	6.17	3.70 F	149.7	11.0	4.0
Dunlop Holding	DLP	1.50	1.38	1.44	.00	.00	1.94	1.13	-.23	-1.75	.84	61.90	-.02	-.51 S	-118.6	-21.0	.0
Firestone Tire	FIR	12.38	9.75	12.38	2.38	23.75	12.38	6.13	.63	1.77	2.49	27.02	-2.11	-2.03 Q	-383.0	-47.0	-2.5
Gen Tire	GY	25.13	21.50	25.00	3.25	14.94	25.13	12.00	.47	.60	3.33	-2.50	1.65	-1.59 F	-49.0	-8.0	1.8
Goodrich B F	GR	28.13	22.63	26.88	4.13	18.13	28.13	16.38	.69	.14	3.67	-2.41	3.57	-1.32 F	-26.9	32.0	2.0
Goodyear Tire	GT	19.50	17.75	19.50	1.63	9.09	19.50	11.00	.08	1.26	-.62	32.05	2.85	.83 F	41.0	5.0	2.4
Mohawk Rub	MWK	28.13	26.25	27.88	1.88	7.21	28.13	9.75	.22	1.20	-2.50	27.81	3.86	2.26 F	141.2	-14.0	2.6
Schenuit Ind	SCH	32.50	32.38	32.50	.00	.00	32.50	18.00	-.07	.01	-12.45	.00	4.83	1.12 N	23.8	38.0	5.2
Uniroyal Inc	R	7.25	6.00	6.88	.88	14.58	7.25	3.13	.10	.23	-1.31	-5.67	-.29	4.21 F	NE	-56.0	-.3
Rubber Products																	
Amerace Corp	AAE	20.88	19.13	20.88	.88	4.38	24.13	16.75	-.25	1.12	-.54	33.22	2.84	-.63 F	-18.1	7.0	3.1
Am Biltrite	ABL	11.88	7.63	10.50	2.75	35.48	11.88	5.75	1.13	2.00	7.88	-36.36	-4.78	-6.04 F	-479.3	NE	-6.2
Carlisle Corp	CSL	94.00	85.00	87.25	-4.75	-5.16	94.75	18.75	-.09	.21	-3.02	-3.96	5.56	1.48 F	36.2	57.0	6.8
Dana Corp	DCN	28.88	25.25	28.63	3.00	11.71	28.88	17.88	.13	.62	.25	-30.19	2.78	-2.88 Q*	-57.9	-6.0	3.8
Dayco Corp	DAY	12.63	11.63	12.25	.25	2.08	13.50	9.75	-.12	.11	.46	6.85	1.10	-1.28 Q	-57.9	-10.0	1.2
Grt Amer Ind	GRI	17.00	15.25	16.88	1.38	8.87	17.75	7.38	.02	.97	3.50	39.66	4.08	.17 F	4.3	29.0	5.6
OSullivan Cp	OSL	14.38	12.63	14.38	1.63	12.75	14.88	7.81	.18	1.65	2.41	45.31	2.18	.35 F	19.1	20.0	6.7
Pantasote Inc	PNT	4.13	3.63	3.75	-.25	-6.25	4.41	2.16	-.06	-.76	-7.25	-27.08	.30	.02 F	7.1	-18.0	.8
Plymth Rub A	PLRA	5.00	4.13	5.00	.88	21.21	5.00	2.00	.99	2.67	2.67	30.82	.02	.15 F	NE	NE	.0
Plymth Rub B	PLRB	4.00	3.50	4.00	.13	3.23	4.50	1.63	1.15	3.35	1.57	33.33	NA	NA	NA	NA	NA
Rubbermaid	RBD	27.50	23.38	27.50	3.75	15.79	29.25	20.00	.21	1.13	3.62	39.61	2.61	-.48 F	-15.5	13.0	6.5
West Co	WST	25.63	19.13	25.00	5.50	28.21	25.63	11.00	.86	.14	4.62	-9.14	2.55	.50 F	24.3	23.0	6.7

(KEY: NA—Not Applicable NC—Not Calculable NE—Negative Earnings)
Q—First quarter S—Six months N—Nine months F—Fiscal year
**—Other than a quarterly multiple resulting from a fiscal year change*
Table prepared by Media General Financial Services, Richmond, Va. 23261

Financial statements

Sales for **Armstrong Rubber's** first quarter, ended December 31, 1980, were $109,828,000, producing $4,019,000, or $2.22 per common share in net earnings. In other financial news, the company's directors declared a 30 cents-per-share dividend on the outstanding common stock, payable April 1 to shareholders on record March 4.

Consolidated net earnings for **Bandag's** 1980 fiscal year came to $27,352,000 or $2.27 per share on consolidated net sales of $330,918,000. For its fourth quarter alone, the company reported earnings of $8,900,000, or 74 cents per share on sales of $92,822,000. In another financial report, Bandag declared a regular quarterly dividend of 20 cents per share, representing a 14.3% increase over the previous 17.5 cents per share dividend. It is payable April 23 to stockholders of March 23 record.

Preliminary figures for **Carlisle's** fourth quarter, ended December 31, 1980, came to $92,430,000 in net sales, producing $7,668,000 in net earnings or $1.64 per share. For the entire year, the company reported net sales of $380,800,000 earning $25,776,000, or $5.56 a share.

In another financial announcement, Carlisle's directors proposed a two-for-one split of the common stock, subject to stockholder approval at the April 20 meeting. Also pending approval at the meeting will be the increase of the authorized number of common shares to 25 million shares with par value of $1 per share from the 6 million

Summary

P/E	DIVIDENDS			FINANCIAL POSITION					
	Indicated Dvd. Rate			(Last Fiscal Year) In $Millions			(Last Fiscal Year) Per Share		
P/E Ratio Today	Amt	Yield	Last x Dvd Date	Revenue	Earnings	Current Ratio	Long Term Debt	Stock Equity	Last Bal Sheet Date
	$	%		$	$		$	$	
13.2	.00	0	00-00-00	136.6	2.9	3.0	1.9	3	1279
3.4	.00	.0	06-27-80	59.0	3.9	1.2	.9	6	1279
NE	1.20	3.8	02-26-81	401.3	-16.4	2.5	48.5	59	0980
10.5	.80	3.4	03-17-81	296.5	25.3	3.9	1.1	12	1279
6.1	.90	2.4	02-23-81	283.2	5.2	2.5	27.7	25	1279
NE	.15	10.4	11-18-80	3480.8	.0	1.8	4.5	4	1279
NE	.30	2.4	12-29-80	4850.5	-122.0	1.5	10.4	23	1080
15.2	1.48	5.9	02-02-81	2215.2	40.8	1.9	9.7	40	1180
7.5	1.56	5.8	02-24-81	2988.1	82.6	1.9	26.8	55	1279
6.8	1.30	6.7	02-06-81	8238.7	146.2	2.1	20.4	30	1279
7.2	1.20	4.3	03-02-81	210.2	1.9	2.3	24.0	31	1279
5.6	1.00	3.1	11-07-80	77.6	4.0	2.5	17.9	25	0979
NE	.00	.0	08-22-78	2574.6	-120.5	2.1	23.1	17	1279
7.4	1.32	6.3	03-10-81	336.5	12.4	2.3	21.1	43	1279
NE	.30	2.9	03-17-81	207.6	3.3	2.3	10.8	21	1279
15.7	1.44	1.7	02-09-81	324.4	18.7	2.4	8.2	18	1279
13.7	1.60	5.6	02-19-81	2524.0	95.7	2.1	9.7	28	0880
13.2	.56	4.6	04-01-81	716.4	8.6	2.2	29.9	26	1080
4.1	.00	.0	00-00-00	95.9	5.9	1.7	9.5	15	1279
6.6	.60	4.2	03-10-81	58.3	3.6	2.9	.0	16	1279
12.5	.00	.0	12-24-80	143.9	1.1	1.7	4.7	8	1279
250.0	.00	.0	00-00-00	60.1	-.2	1.4	.0	7	1179
NA	.00	.0	00-00-00	NA	NA	NA	NA	NA	NA
10.5	1.06	3.9	02-06-81	308.9	20.1	1.9	2.0	18	1280
9.8	.60	2.4	04-14-81	122.0	7.9	3.1	3.7	14	1279

All information in this table is based on sources believed to be reliable, but its accuracy is not guaranteed. Every effort will be made to correct errors, when discovered in future editions.

shares currently authorized without the par value. There were 4,563,679 shares outstanding at the end of the year. The board also declared a regular 36-cents-a-share quarterly dividend on present shares that was paid on February 27 to stockholders of February 17 record. It was previously 28 cents a share.

For fiscal year 1980, ended November 30, **Eagle Picher Industries** reported net sales of $543.3 million that produced net income of $21.3 million or $2.14 per share. For its fourth quarter, ended November 30, net sales came to $142,157,727. Income before taxes was $10,890,380, while net income totaled $6,390,380, or 65 cents per share. In another financial statement, the company declared regular quarterly dividends on its convertible preference shares, payable April 2 to shareholders of record March 6.

For **Firestone Tire and Rubber's** first quarter, ended January 31, net income totaled $76 million, or $1.32 a share, on sales of $1.06 billion. This compares to first quarter 1980's reported loss of $14 million, or 24 cents a share on $1.15 billion in sales.

For its six months, ended December 31, **First Mississippi** reported sales of $156.4 million producing earnings of $12.2 million, or 57 cents a share. These results, which were a 56% increase in net earnings on a 48% increase in sales, were adjusted to give effect to the 150% stock dividend paid December 17.

For its second quarter ended December 31, the company reported sales of $98.8 million that provided net earnings of $8.4 million, or 39 cents per share adjusted.

In another statement, the company declared a 6 cents per share quarterly cash dividend on common stock, payable April 30 to shareholders of March 31 record.

BFGoodrich reported 1980 net income of $61.7 million, or $3.57 a share, from sales of $3.1 billion. Net income for its 1980 fourth quarter amounted to $22.7 million, or $1.30 a share, from $779.8 million in sales.

Goodyear Tire and Rubber reported record 1980 sales of $8,444,015,000 that produced earnings of $230.7 million, or $3.18 per share. Sales of $2,213,517,000 in the 1980 fourth quarter made a net income of $78.9 million, or $1.09 per share. Previous records were set in 1979, with sales for that year totaling $8,238,676,000; and sales for the fourth quarter amounting to $2,074,821,000. Earnings from both surpassed records set in 1978.

Lubrizol's directors have declared an increase in the quarterly dividend and a proposed two-for-one stock split, pending approval of the shareholders at the annual meeting on April 27. If approved, the split would take effect in late May through a dividend to shareholders of May 8 record. This would be at the rate of one share for each share outstanding. In other action, Lubrizol raised its quarterly cash dividend 20% to 54 cents per share from 45 cents per share, and was paid March 10 to shareholders of record February 10. This is equal to 27 cents per share on post-split shares.

Pfizer announced fourth quarter worldwide sales of $825.3 million, producing income before taxes and minority interests of $96.7 million. Net income amounted to $64.5 million or 88 cents a share. For the year, worldwide sales came to $3,029.3 million, with income before taxes and minority interests totaling $411.8 million. Net income was reported at $254.8, or $3.48 a share.

In another financial announcement, Pfizer's board of directors declared a first quarter dividend of 40 cents per share on the common stock. Paid March 20 to shareholders of record February 19, this was a 4-cent increase over the 36 cents of the previous quarter.

Witco Chemical reported 1980 sales of $1,175,695,000 producing net income of $40,954,000, or $4.50 per share. This is the first time Witco Chemical reported sales reaching $1 billion. Fourth quarter sales of $311,767,000 earned $10,173,000, or $1.11 per share.

U.S.& World Rubber News

Latin America SR consumption to double

HOUSTON — Stating that Latin America is the brightest region on the international rubber scene, an International Institute of Synthetic Rubber Producer's report predicts total rubber consumption for the area will double within the next decade.

The ten-year forecast compiled by the Institute's Latin American section shows consumption will leap to more than 1.5 million metric tons by 1990. Polybutadiene leads the way with a 143% increase in consumption.

This record growth rate, about 7.8% compounded annually, will put Latin America consumption of synthetic rubber above the 1.1 million ton level in ten years.

Total New Rubber Consumption Forecast
Latin America
(Thousand Metric Tons)

Type	1980 Estimate	1981	1985	1990
SBR-Solid	348.2	373.0	496.6	712.6
SBR-Latex	13.5	14.3	19.5	26.4
Polybutadiene	89.0	96.7	138.4	215.9
Polyisoprene	4.4	4.7	6.2	9.0
Ethylene-Propylene	11.1	11.6	17.0	29.9
Polychloroprene	19.1	19.9	25.8	35.3
Butyl	36.8	39.5	52.7	74.3
Nitrile	9.2	9.8	13.5	13.2
Other Synthetic	7.5	8.0	9.7	12.6
TOTAL SYNTHETIC	538.8	577.5	779.4	1,135.2
Natural Rubber	198.5	210.5	233.1	402.7
TOTAL NEW RUBBER	737.3	788.0	1,062.5	1,537.9
Percent Synthetic	73.1	73.3	73.4	73.8

URW chief won't seek re-election

AKRON — Saying he hopes he left a strong legacy, Peter Bommarito, told a United Rubber Workers union meeting he would not seek re-election this year.

Bommarito, union president since 1966, said "I believe I have made a difference. But while one man can make a difference, no man is an island." The 65 year old Bommarito will close out his sixth term as International president in October.

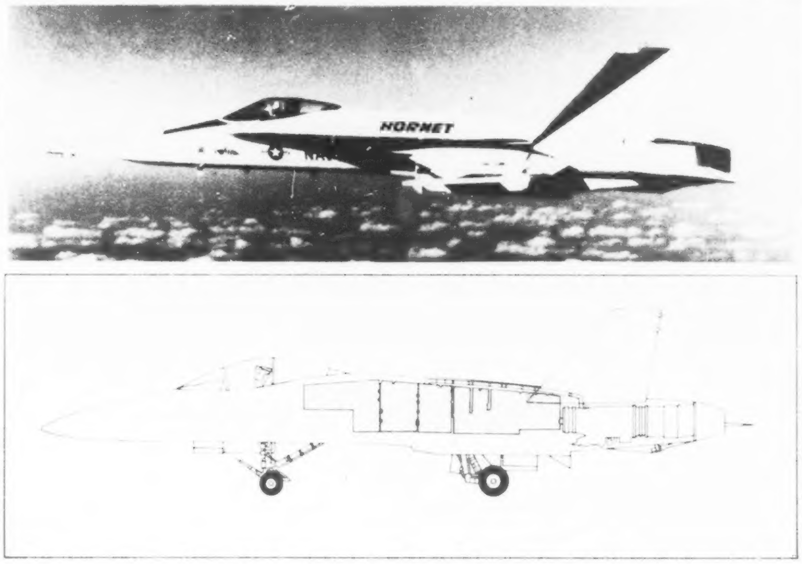
Bommarito indicated after being re-elected in 1978 that this term would be his last. In his last campaign, his toughest, he beat reform candidate Bob Long 1,093-685, the closest URW presidential election in 30 years.

Presently there are no announced candidates for the position, but it is believed International vice president Milan Stone will run and possibly Long will take another shot. Stone was re-elected to his v-p post in 1978 on the Bommarito ticket.

Bommarito began his career in the rubber industry at U.S. Rubber (Uniroyal) in Detroit in 1939. He was president of local 101 from 1957 to 1960. In 1960 he was elected International vice president.

He has been called Labor's "most eloquent spokesman" in occupational safety and health. Under his direction, the URW became the first international union to hire a professional industrial hygienist. He is an AFL-CIO vice president and executive council member and vice president of the AFL-CIO Industrial Union Department (IUD).

Peter Bommarito



NEWEST aircraft employed by the U.S. Navy and Marine Corps is the F-18 Hornet, a strike fighter, in flight in the top photo. The plane, manufactured by McDonnell Douglas, is equipped with five, tailor-made fuel cells, capable of carrying 1,500 gallons of fuel. Sole manufacturer of the cells — greyed in the drawing — is the Firestone Coated Fabrics Company of Magnolia, Ark. The cells are made of nylon fabric, coated with nitrile rubber.

Aerospace market growth seen for advanced composites

NEW YORK — Usage of carbon and kevlar fibres in civil and military aircraft and missiles will increase by over 600% in the next five years a report by Frost & Sullivan contends.

The marketing research firm predicts that aerospace will emerge as the major end-use sector for high performance resin-based composite materials by 1985. This market will account for some two million pounds of carbon fibre and even larger quantities of kevlar.

"With the need to replace existing civil aircraft fleets and expected increased in defense spending, only space applications (a relatively small market) will be affected by the current economic recession," the report says.

Growth in the aerospace field will taper off somewhat for the balance of the decade, amounting to 15-25% per year. Boron fibre, the most expensive of the raw materials, will maintain its current outlets, but expansion will be slight and confined to missile and military plan applications.

Sporting goods, for sometime the most important outlet for advanced composites, will have a near term increase of around 30%, declining to around 7% per year by 1985.

Good long-term prospects for advanced composites are anticipated in asbestos replacement, high speed parts utilized in general engineering, as well as pipes, storage vessels and other components used in chemical engineering. Automotive applications will not become significant before 1985. By 1990, demand in the general, chemical and automotive engineering sectors could exceed that for aerospace, with particular interest seen for hybrids with continuous glass filaments.

For the time being, major inroads into these market sectors are inhibited by high raw materials costs and labor-intensive processing methods associated with high performance composites. "The large increases in production capacity announced by all major suppliers of carbon fibre and kevlar will meet increased demand and produce economies of scale," the report notes. "However, automated production and faster curing resins are required to capture general engineering markets' extensive use of hyrbridization — i.e., maximum use of low cost glass fibre and minimum use of high cost high performance fibre.

The report adds that high interest rates and the current downturn in worldwide industrial production inhibit innovation and the development of new products which could use high performance composites.

One set of roadblocks the advanced composite industry appears to be capable of avoiding are on the legislative front. If anything, energy-saving characteristics seem to favor composites. In many applications, composites are less energy-intensive than conventional materials when compared on an equivalent performance basis.

On a worldwide scale, the United States is presently the leading market for high performance composites, consuming over half the world's carbon fibre, two-thirds of kevlar and almost all boron fibre. It is expected to retain this position despite a trend among some American end-users to subcontract to fabricators in Europe and Japan.

U.S. launches domestic natural rubber program

WASHINGTON, D.C. — Efforts to implement a domestic natural rubber program in the U.S. intensified under a new guayule seed production program begun by the Agricultural Department.

The new program will produce seed to plant large acreage for commercial production. Seed production will be centered in Arizona, California, New Mexico and Texas, where climates are suited for this desert shrub. Guayule was a source of natural rubber prior to the emergence of synthetics.

The U.S. imports all of its natural rubber. In 1979 imports totalled more than 760,000 metric tons at a cost of over $157 million.

This spring 120 acres will be planted with an additional 80 acres planted in the fall. From these plantings will come certified seed for commercial use.

RMA MONTHLY TIRE REPORT
(Through December)

	Cum. 1980	Cum. 1979
Passenger Tires		
Shipments		
Original Equipment	34,932,806	48,188,122
Replacement	106,912,217	121,921,966
Export	4,074,250	3,909,261
Total	145,919,273	174,019,349
Production	130,860,623	168,028,166
Truck & Bus		
Shipments		
Original Equipment	5,294,327	9,884,053
Replacement	24,358,776	28,858,554
Export	1,491,072	1,167,437
Total	31,144,175	39,910,044
Production	28,402,109	38,659,140
Tractor Implement Tires		
Shipments		
Original Equipment	1,569,484	2,106,662
Replacement	2,559,792	3,138,938
Export	204,755	199,366
Total	4,334,031	5,444,966
Production	4,195,002	5,539,767
Tread Rubber		
(Figures in 000 lbs.)		
Shipments		
Domestic	422,078	454,173
Export	45,515	40,187
Total	467,593	494,360
Production	473,100	504,173

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BILL PUBLICATION

Rubber World

MAY 1981
TECHNOLOGY/MARKETS/NEWS
VOLUME 184, NO. 2

Kastein on compounding

also in this issue:

Glass fiber radial reinforcement

Polymerization & synthetic rubber

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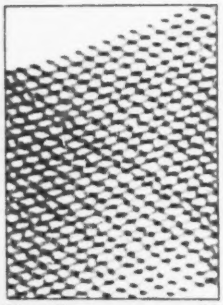
Pigment is added to calendered compound at Pantasote's Butler, N.J. plant. Photo courtesy of Pantasote Inc., Greenwich, Conn.



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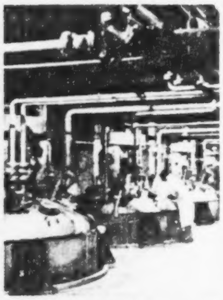

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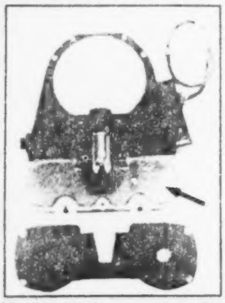

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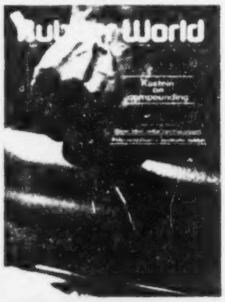

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Rubber World Stock

		PRICE							TREND TO MARKET				EARNINGS/SHARE				
					Change		52 Week		Price Trend (% per day)		Volume Trend (% per day)			Latest 12 Months vs Preceding 12 Months Change		5 Year Annual Growth Rate	Profit Margin
Name	Symbol	High	Low	Close	Amt	Pct	High	Low	Last 30 Days	Last 5 Days	Last 30 Days	Last 5 Days	Last Fiscal Year	Amt	Pct		
		$	$	$	$	%	$	$	%	%	%	%	$	$	%	%	%
Tires and Inner Tubes																	
Aegis Corp	AO	2.50	2.25	2.25	-.13	-5.26	2.75	1.38	-.17	-.42	-4.51	13.32	.18	-.09 F	-33.3	3.0	1.3
Alliance Tire	ATRA	8.13	7.25	8.13	.25	3.17	11.13	5.91	-.93	3.00	6.11	-15.91	1.45	1.45 N	149.4	20.0	6.6
Armstrong Rub	ARM	39.88	33.13	37.25	3.25	9.56	39.88	14.50	.94	.61	.69	17.31	-10.17	-13.77 Q	-303.9	-41.0	-4.1
Bandag Inc	BDG	24.75	22.63	23.00	.00	.00	25.25	14.25	-.21	-.67	4.71	48.30	2.27	.28 F	14.0	9.0	8.3
Cooper Tire	CTB	40.00	35.00	36.75	-1.00	-2.65	42.00	9.63	-.09	-1.11	-.39	37.24	6.17	3.70 F	149.7	11.0	4.0
Dunlop Holding	DLP	1.63	1.38	1.63	.13	8.33	1.94	1.25	.18	1.81	1.61	16.67	-.02	-.51 S	-118.6	-21.0	.0
Firestone Tire	FIR	13.38	11.63	11.75	-1.38	-10.48	13.38	6.13	.05	.14	-2.09	9.03	-2.11	-2.03 Q	-383.0	-47.0	-2.5
Gen Tire	GY	26.13	23.50	25.13	-.50	-1.95	26.13	12.50	.13	-.17	-.39	23.40	1.65	-.05 Q	-2.2	-20.0	1.8
Goodrich B F	GR	27.38	25.00	26.00	-1.25	-4.59	28.13	17.75	-.17	-.09	-.42	23.41	3.57	-1.32 F	-26.9	32.0	2.0
Goodyear Tire	GT	20.25	17.88	18.50	-1.38	-6.92	20.25	11.50	-.13	1.08	-.37	-12.42	2.85	.83 F	41.0	5.0	2.4
Mohawk Rub	MWK	32.50	27.00	32.50	4.75	17.12	32.50	9.75	.42	2.36	3.55	38.75	3.86	2.26 F	141.2	-14.0	2.6
Schenuit Ind	SCH	.00	.00	32.50	.00	.00	32.50	20.25	-.11	.57	-19.35	.00	4.83	1.12 N	23.8	38.0	5.2
Uniroyal Inc	R	8.25	7.13	8.13	.38	4.84	8.25	3.13	.32	3.03	.86	49.92	-.29	4.21 F	NE	-56.0	-.3
Rubber Products																	
Amerace Corp	AAE	25.25	21.00	24.00	2.50	11.63	25.25	18.25	.81	-.14	3.08	-36.52	2.84	-.63 F	-18.1	7.0	3.1
Am Biltrite	ABL	10.25	9.63	10.13	.00	.00	11.88	5.75	.37	.75	-8.09	34.72	-4.78	-6.04 F	-479.3	NE	-6.2
Carlisle Corp	CSL	105.25	85.25	100.25	14.25	16.57	105.25	20.00	.61	-.57	.89	-22.74	5.56	1.48 F	36.2	57.0	6.8
Dana Corp	DCN	29.75	27.63	29.00	-.50	-1.69	29.75	17.88	.20	.75	-.06	35.43	2.78	-2.88 Q	-57.9	-6.0	3.8
Dayco Corp	DAY	14.38	12.25	13.25	.88	7.07	14.38	9.75	.32	.68	-1.06	4.70	1.10	-1.28 Q	-57.9	-10.0	1.2
Grt Amer Ind	GRI	18.88	17.00	17.25	-.25	-1.43	18.88	8.00	.35	-.57	-2.11	24.42	4.08	.17 F	4.3	29.0	5.6
OSullivan Cp	OSL	15.25	14.25	15.25	.75	5.17	15.25	7.81	.45	.92	.70	-36.11	2.18	.44 Q	23.9	8.0	6.7
Pantasote Inc	PNT	4.13	3.00	3.25	-.63	-16.13	4.41	2.63	-.23	-5.38	7.70	36.76	.30	.02 F	7.1	-18.0	.8
Plymth Rub A	PLRA	6.38	5.00	6.13	1.00	19.51	6.38	2.00	.94	3.11	2.98	43.75	.02	.15 F	NE	NE	.2
Plymth Rub B	PLRB	6.13	4.13	6.13	1.88	44.12	6.13	1.63	1.19	5.51	7.19	2.88	NA	NA	NA	NA	NA
Rubbermaid	RBD	33.00	27.50	32.00	3.00	10.34	33.00	21.25	.70	.96	3.75	9.71	2.61	-.48 F	-15.5	13.0	6.5
West Co	WST	28.00	25.25	27.88	2.00	7.73	28.00	11.50	.27	2.35	-1.18	56.44	2.55	.50 F	24.3	23.0	6.7

(KEY: NA—Not Applicable NC—Not Calculable NE—Negative Earnings)
Q—First quarter S—Six months N—Nine months F—Fiscal year
**—Other than a quarterly multiple resulting from a fiscal year change*
Table prepared by Media General Financial Services, Richmond, Va. 23261

Financial statements

For its first fiscal quarter, ended December 31, 1980, **Cabot** reported net income of $27,875,000, or 89 cents per share on net sales and other operating revenues of $386,770,000.

Cities Service reported preliminary 1980 net income totaling $477.5 million, or $5.73 a share, a 37% increase over 1979 earnings of $347.5 million, or $4.18 per share. Fourth quarter 1980 net income came to $107.8 million, or $1.29 a share, as opposed to the $106.2 million, or $1.28 a share earned in the 1979 fourth quarter.

For its first fiscal quarter, ended December 27, 1980, **Compo Industries** reported a net profit of $102,000, or 3 cents per share on revenues of $30,708,000. This compares to a net profit of $618,000 or 19 cents per share from revenues of $31,672,000 in 1979. Losses had been reported for the last three quarters of the year.

Cooper Tire and Rubber reported record 1980 sales of $323,953,050 that were up 14.4% from the previous year's $283,236,372. The 1980 sales figure produced a net income of $12,824,755, or $6.72 per share, compared to the $5,152,154 or $2.60 per share of 1979. Fourth quarter 1980 sales amounted to $93,602,851, producing net income of $6,306,068, or $3.34 per share. Net income for 1979's fourth quarter was reported at $1,585,588, or 81 cents per share on sales of $69,026,640, a 35.6% increase.

Summary

P/E	DIVIDENDS			FINANCIAL POSITION					
P/E Ratio Today	Indicated Dvd. Rate		Last x Dvd Date	(Last Fiscal Year) in $Millions		Current Ratio	(Last Fiscal Year) Per Share		Last Bal Sheet Date
	Amt	Yield		Revenue	Earnings		Long Term Debt	Stock Equity	
	$	%		$	$		$	$	
12.5	.00	0	00-00-00	136.6	2.9	3.0	1.9	3	1279
3.4	.00	0	06-27-80	59.0	3.9	1.2	9	6	1279
NE	1.20	3.2	02-26-81	401.3	-16.4	2.5	48.5	59	0980
10.1	.80	3.5	03-17-81	330.9	27.4	3.3	1.2	13	1280
6.0	.90	2.4	02-23-81	283.2	5.2	2.5	27.7	26	1279
NE	.15	9.2	11-18-80	3480.8	0	1.8	4.5	4	1279
NE	.30	2.6	03-30-81	4850.5	-122.0	1.5	10.4	23	1080
11.4	1.48	5.9	02-02-81	2215.2	40.8	1.9	9.7	40	1180
7.3	1.56	6.0	02-24-81	3079.6	61.7	1.9	31.2	55	1280
6.5	1.30	7.0	02-06-81	8444.0	206.7	2.1	17.3	32	1280
8.4	1.20	3.7	03-02-81	180.7	4.7	2.2	17.2	33	1280
5.6	1.00	3.1	11-07-80	77.6	4.0	2.5	17.9	25	0979
NE	.00	0	08-22-78	2574.6	-120.5	2.1	23.1	17	1279
8.5	1.32	5.5	03-10-81	336.5	12.4	2.3	21.1	43	1279
NE	.30	3.0	03-17-81	207.6	3.3	2.3	10.8	21	1279
18.0	1.44	1.4	02-09-81	324.4	18.7	2.4	8.2	18	1279
13.9	1.60	5.5	02-19-81	2524.0	95.7	2.1	9.7	28	0880
14.2	.56	4.2	04-01-81	716.4	8.6	2.2	29.9	26	1080
4.2	.00	.0	00-00-00	95.9	5.9	1.7	9.5	15	1279
6.7	.60	3.9	03-10-81	58.3	3.6	2.9	0	16	1279
10.8	.00	.0	12-24-80	143.9	1.1	1.7	4.7	8	1279
306.3	.00	.0	00-00-00	63.8	.1	1.5	0	7	1180
NA	.00	.0	00-00-00	NA	NA	NA	NA	NA	NA
12.3	1.08	3.4	02-06-81	308.9	20.1	1.9	2.0	18	1280
10.9	.60	2.2	04-14-81	148.2	9.9	2.1	3.3	17	1280

All information in this table is based on sources believed to be reliable, but its accuracy is not guaranteed. Every effort will be made to correct errors, when discovered in future editions.

Dow Chemical reported net income of $242.3 million, or $1.33 a share, for its 1980 fourth quarter. This, on sales of $2.77 billion. For the year, the company reported an income of $804.5 million, or $4.42 a share on sales of $10.63 billion.

Exxon's annual meeting is set for May 14 at 9:30 a.m. for the purpose of electing directors and approving other business decisions. It will take place at the Music Hall, 810 Bagby St., Houston, Tex.

For its first quarter of 1981, **General Tire and Rubber** reported net sales of $568,534,000 that produced a net income of $2,126,000, or 9 cents per share. This compares to first quarter 1980's net loss of $11,254,000, or 47 cents per share on sales of $513,329,000. The quarter ended February 28.

Earnings for **W.R. Grace's** fourth quarter totaled $67.4 million, or $1.44 a share, on sales of $1.71 billion. Earnings for the entire year came to a record $283.8 million, or $6.08 a share, on sales of $6.1 billion.

Gulf Oil reported 1980 earnings of $1.41 billion, or $7.21 per share from $28.79 billion revenues. This, compared to 1979 earnings of $1.32 billion, or $6.78 per share on sales of $26.14 billion. For its fourth quarter, the company reported a 17% decline in earnings amounting to $304 million, or $1.56 per share, on sales of $7.60 billion. This is in relation to fourth quarter 1979's $366 million, or $1.88 per share from sales totaling $7.73 billion.

Net sales of $21,718,000 for **Harrelson Rubber's** 1980 fiscal year produced a net loss of $594,000, or 47 cents per share. This, in comparison to fiscal 1979's net income of $903,000, or 72 cents per share on sales of $20,055,000.

For 1980, **Nalco** reported sales of $616.7 million and net earnings of $72.3 million, or $3.61 a share. This is a 7% increase over $578.9 million sales of 1979 and a 14% increase over 1979 earnings of $63.3 million, or $3.18 a share. Fourth quarter 1980 sales for Nalco reached $162.6 million, up 3% from $158.5 million reached in the 1979 fourth quarter. Net earnings were reported to be $20.1 million, or $1 a share, up 22% over 1979's earnings of $16.5 million, or 83 cents a share.

Along with an extraordinary gain, **Stauffer Chemical's** reported 1980 earnings were $136.6 million, or $3.11 a share, about even with that of 1979, although the company said sales rose approximately 11% to $1.7 billion. After the extraordinary gain, fourth quarter earnings came to $42.4 million, or 97 cents a share, on sales of $425.4 million.

Net income for **St. Joe Mineral's** fourth quarter was reported at $30.5 million, or 68 cents a share. This, on sales of $275.4 million. For fiscal 1980, net came to $117.1 million, or $2.60 a share, on sales of $1.28 billion.

Sales of $596.2 million produced a net income of $4.7 million, or 17 cents a share, for **Uniroyal's** 1980 fourth quarter, ended December 28. This compares to a $112 million loss in 1979's fourth quarter. Sales for the year were reported to be $2.3 billion, as opposed to 1979's $2.6 billion. The net loss for 1980 was $7.8 million; for 1979, $119.7 million.

Upjohn reported 1980 net earnings of $170 million, or $5.71 per share. Sales for the year, ended December 31, amounted to $1.8 billion. For the 1980 fourth quarter, Upjohn reported sales of $451 million that made net earnings of $35 million, or $1.17 per share.

Sales for **Wallace Murray's** fiscal 1980 year, totaling $577,490,000 produced net income of $33,614,000 or $5.02 per share. In the fourth quarter, net income was $11,043,000, equal to $1.65 per share, from sales totaling $149,995,000.

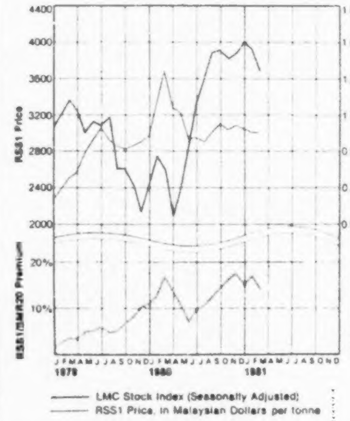
U.S. & World Rubber News

High NR stocks impede price recovery

AKRON, OH — With natural rubber consumption falling faster than production since last summer, an emerging surplus has delayed the long-expected upturn in NR prices, according to a report compiled by Landell Mills Commodities (LMC) of London.

The worldwide decline in consumption of NR was estimated at 3.7% for the twelve months to February 1981, with production falling by 1.2%. For synthetic rubbers, the corresponding declines were 5% for consumption and 8.8% for production.

Natural Rubber Price and Stock Movements



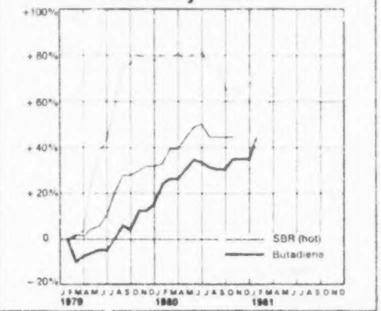
The causes of the decline in demand are the recession affecting industrial countries and the high relative price of petroleum. The report states that since 60% to 70% of rubber is used in the transportation industry, production of lighter cars is continuing to reduce rubber consumption. A third element in falling demand according to LMC is the penetration of longer-lasting radial tires.

Declining tire production in Comecon countries is contributing to increased volume of low-priced synthetic rubber exports reaching Western markets. As well as contending with this, Western synthetic rubber producers face heavy feedstock cost increases, with butadiene and styrene up 80% and 70% respectively, while slack demand makes it difficult to pass on these increases.

Although total supply in 1980 fell short of official forecasts, the sudden and rapid decline in consumption easily outstripped the supply shortfall from mid-1980 onward. Before the decline in consumption advanced, stocks had already declined to low levels. This was associated with the most recent major upturn in natural rubber prices last Spring. However, this situation changed quickly as consumption fell, raising stocks both in absolute terms and, still more rapidly, as a ratio to consumption. The seasonally-adjusted index of world natural rubber stocks rose from 94.5 in March to 103.0 in August, and has not changed significantly since then.

In terms of consumption, the oil price rise of early 1980 has been the dominant influence, with its general adverse impact on the overall level of industrial output coming on top of the more direct effect of oil price rises on the auto industry — fewer new registrations and lower replacement tire demand as the mileage of existing vehicles responds to higher fuel prices.

Percentage changes in U.S. price of SBR and its Monomers since January 1979



As synthetic rubber producers, whose profits have been severely impacted, find the pressure to pass on increased costs despite weak demand, natural rubber prices are expected to gradually move up accordingly. High interest rates for synthetic rubber producers have forced production cuts in order to keep inventories down to manageable levels in an industry where economies of scale are

Supply/Demand Balance for Natural Rubber ('000 tonnes)

	1979 Total	1980 Jan to Mar	1980 Apr to Jun	1980 Jul to Sep	1980 Oct to Dec	**1980 Total**	1981 Jan to Feb	**Latest 12 months**
World Production	**3855**	945	880	960	1010	**3795**	685	**3795**
—World Demand	**3870**	1005	940	880	945	**3770**	655	**3755**
Change in Stocks	**−15**	−60	−60	+80	+65	**+25**	+30	**+40**
Total Stocks at end period	**1560**	1500	1440	1520	1585	**(1585)**	1615	**(1615)**
LMC Index of World N.R. Stocks (Seasonally Adjusted)	**96.2**	**94.5**	**100.7**	**103.0**	**103.3**	**(103.3)**	**103.0**	**(103.0)**

Sources: Tables 2 and 3

Note: The LMC Stock Index measures the ratio of stocks to consumption, both seasonally adjusted. It takes the value of 100 when end-period stocks equal five times the previous month's consumption.

Synthetic Rubber — Supply/Demand Balance

	1979 Total	1980 Jan to Mar	1980 Apr to Jun	1980 Jul to Sep	1980 Oct to Dec	1980 Total	1981 Jan to Feb	Latest 12 months	% change on previous 12 months
Production									
N. America	**2960**	669	544	464	595	**2272**	420	**2255**	− 23.3%
E.E.C.	**1860**	472	459	354	420	**1705**	280	**1683**	− 9.9%
Japan	**1107**	292	288	279	225	**1084**	155	**1035**	− 7.9%
E. Europe	**2556**	642	645	650	670	**2617**	460	**2650**	+ 3.2%
Other	**807**	211	214	210	220	**855**	150	**866**	+ 7.3%
Total	**9290**	**2285**	**2150**	**1965**	**2130**	**8533**	**1465**	**8490**	**− 8.8%**
Consumption									
N. America	**2678**	595	455	473	540	**2063**	380	**2059**	− 20.7%
E.E.C.	**1520**	396	373	300	380	**1450**	260	**1450**	− 1.1%
Japan	**830**	226	232	223	231	**912**	145	**912**	+ 6.4%
E. Europe	**2485**	630	630	645	645	**2550**	430	**2560**	+ 2.6%
Other	**1537**	400	405	390	390	**1585**	260	**1580**	+ 1.8%
Total	**9050**	**2245**	**2095**	**2030**	**2185**	**8560**	**1475**	**8560**	**− 5.0%**

Source: Rubber Statistical Bulletin, national publications, LMC estimates.

all-important.

List prices remained flat in Europe throughout 1980, the report continues, but it seems reasonable that considerable discounting was needed to shift stocks. Statistics compiled by the U.S. Department of Commerce's price index for styrene-butadiene rubber as well as prices of the principal monomers used in its production point out that butadiene supplies have been depressed by a cutback in ethylene production. The cutback in supply has more than matched that in demand, resulting in upward pressure on prices. Restocking in the U.S.A. is one reason for this increase in demand, together with the seasonal pick-up in the tire industry.

The recent supply-demand balance for synthetic rubbers as a whole during the third quarter of last year saw a sharp production downturn as stock financing became an acute problem. In contrast to natural rubber, synthetic production can be regulated to match demand, though at some cost in economies of scale. Since the third quarter, production and consumption have reached a better balance causing some synthetic rubber producers to pass on some of their cost increases, the LMC report concludes.

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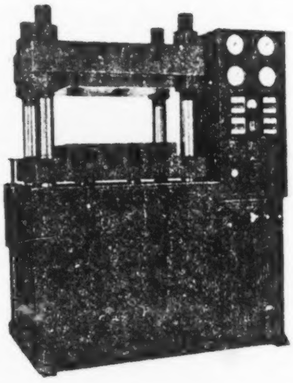

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M.G. O'Neil

General elects M.G. O'Neil chairman

AKRON — General Tire's board of directors elected M.G. O'Neil chairman of the board, replacing T.F. O'Neil who did not seek re-election. M.G. O'Neil will retain his positions as president and chief executive officer.

He has been president since 1960 and CEO since 1977. M.G. O'Neil has been a director since 1950. T.F. O'Neil retains his membership on the General Tire Board and remains chairman and CEO of RKO General.

U.S. demand for SMR on decline

WASHINGTON D.C. — Statistics compiled by the Rubber Research Institute of Malaysia show the recession in the auto industry has reduced U.S. demand for Malaysian Standard Rubber (SMR). The U.S., usually the largest buyer of SMR, dropped behind Italy and the United Kingdom, with 11,670 tons imported the third quarter of 1980.

The U.S. imported 15,618 tons in the first quarter of 1980 and 10,739 during the second. Italy was the top consumer in the latest two quarters, importing over 37,000 tons for the nine months.

Top SMR Importers (3rd quarter 1980)

Country	Tons
Italy	13,314
United Kingdom	11,716
United States of America	11,570
Singapore	10,258
Federal Republic of Germany	9,626
China	7,750
South Korea	7,025
France	6,727
Belgium	5,369
Malaysia	4,746

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Rubber World

TECHNOLOGY/MARKETS/NEWS VOLUME 184, NO. 3 JUNE 1981

Injection molding: can it m

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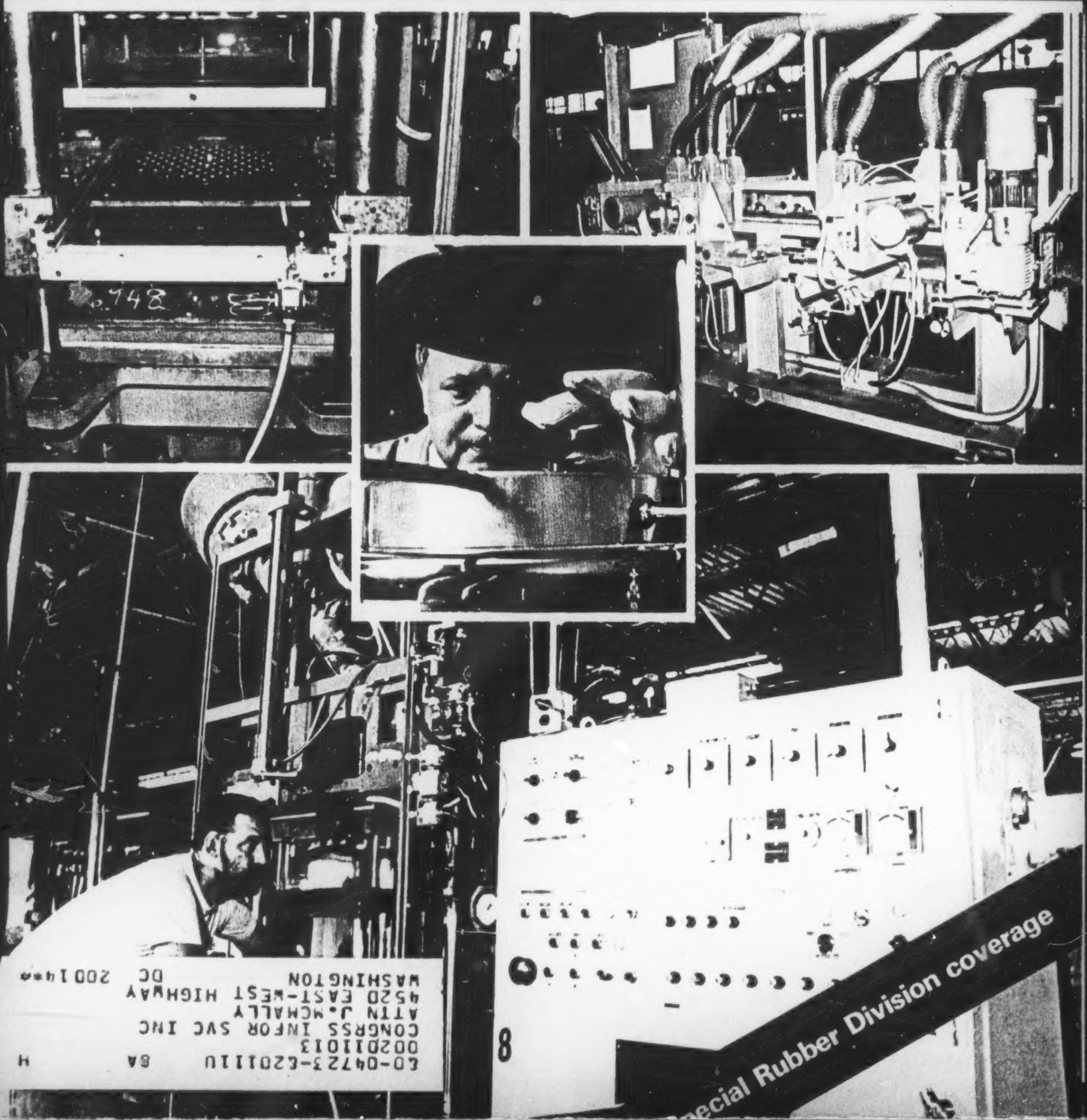
- Liquid silicone
- EPDM accelerator systems
- Rubber-to-metal bonding



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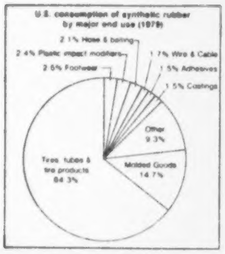

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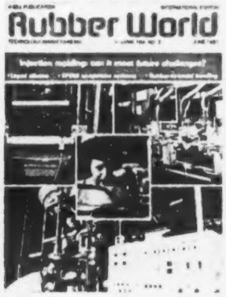

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Rubber World Stock

		PRICE							TREND TO MARKET				EARNINGS/SHARE				
					Change		52 Week		Price Trend (% per day)		Volume Trend (% per day)			Latest 12 Months vs. Preceding 12 Months Change			
Name	Symbol	High	Low	Close	Amt.	Pct	High	Low	Last 30 Days	Last 5 Days	Last 30 Days	Last 5 Days	Last Fiscal Year	Amt.	Pct.	5 Year Annual Growth Rate	Profit Margin
		$	$	$	$	%	$	$	%	%	%	%	$	$	%	%	%
Tires and Inner Tubes																	
Aegis Corp	AO	2.75	2.25	2.63	.25	10.53	2.75	1.38	.63	1.07	3.95	19.02	.18	-.04 Q	-14.8	-5.0	1.3
Alliance Tire	ATRA	14.50	9.13	14.13	5.13	56.94	14.50	7.25	2.34	3.02	9.88	6.74	1.20	.32 Q	38.5	10.0	6.1
Armstrong Rub	ARM	37.88	31.75	35.00	-1.25	-3.45	39.88	16.13	-.36	.86	-2.23	41.71	-10.17	-12.72 S	-249.9	-39.0	-4.1
Bandag Inc	BDG	26.00	22.50	23.75	.75	3.26	26.00	16.63	.08	1.59	-2.25	-26.30	2.27	.24 Q	11.5	12.0	8.3
Cooper Tire	CTB	37.00	31.13	32.25	-4.75	-12.84	42.00	9.63	-.84	.59	.31	21.71	6.17	5.09 Q	226.2	12.0	4.0
Dunlop Holding	DLP	1.81	1.50	1.75	.25	16.67	1.94	1.31	.42	2.36	5.87	58.27	-.02	-.51 S	-118.6	-21.0	0
Firestone Tire	FIR	12.75	11.00	12.00	.38	3.23	13.38	6.63	-.10	.88	.14	14.24	-2.11	-2.03 Q	-383.0	-47.0	-2.5
Gen Tire	GY	26.13	23.88	25.50	.00	.00	26.13	14.56	.05	1.47	-2.87	44.25	1.65	-.05 Q	-2.2	-20.0	1.8
Goodrich B F	GR	27.25	25.00	26.00	.50	1.96	28.13	18.00	.08	-.28	.28	-24.21	3.57	-2.09 Q	-42.7	21.0	2.0
Goodyear Tire	GT	19.25	17.00	17.00	-1.38	-7.48	20.25	12.25	-.12	-.68	.06	-28.74	2.85	.96 Q	51.8	7.0	2.4
Mohawk Rub	MWK	35.63	26.13	27.00	-7.50	-21.74	35.63	10.13	-.65	.18	-3.12	9.20	3.86	3.53 Q	371.5	-3.0	2.6
Uniroyal Inc	R	8.88	7.75	8.50	.38	4.62	8.88	3.25	.50	.98	1.22	22.48	-.29	5.56 Q	NE	-93.0	-.3
Rubber Products																	
Amerace Corp	AAE	24.50	21.13	21.38	-2.63	-10.94	25.25	18.25	-.53	-.17	-8.41	-24.05	2.84	-.77 Q	-21.6	4.0	3.1
Am Biltrite	ABL	10.25	9.63	9.63	-.38	-3.75	11.88	5.75	-.04	.06	-3.72	.00	-4.78	-5.33 Q	-658.0	NE	-6.2
Carlisle Corp	CSL	54.75	42.00	48.00	-3.75	-7.25	54.75	11.75	-.45	2.06	-.28	-7.20	2.78	.80 Q	36.3	43.0	6.8
Dana Corp	DCN	32.75	29.75	31.00	1.13	3.77	32.75	20.00	.33	.22	-3.34	12.64	2.78	-2.88 Q	-57.9	-6.0	3.8
Dayco Corp	DAY	13.38	12.13	12.88	-.25	-1.90	14.38	10.38	-.16	.88	-.59	4.76	1.10	-1.28 Q	-57.9	-10.0	1.2
Grt Amer Ind	GRI	17.25	14.63	15.25	-1.75	-10.29	18.88	8.13	-.64	.47	-1.10	-21.32	4.08	-.02 Q	-.5	24.0	5.6
OSullivan Cp	OSL	16.88	15.50	16.88	1.50	9.76	16.88	7.81	.53	.13	.04	35.42	2.18	.44 Q	23.9	8.0	6.7
Pantasote Inc	PNT	6.25	3.13	4.50	1.25	38.46	6.25	2.84	1.44	-2.20	2.40	36.49	.30	.10 Q	28.5	-18.0	.8
Plymth Rub A	PLRA	7.63	5.50	5.63	-1.38	-19.64	7.63	2.00	-.10	-.55	-6.15	-50.00	.02	.10 Q	NE	NE	.2
Plymth Rub B	PLRB	7.38	5.13	5.13	-2.00	-28.07	7.38	1.63	.07	-1.76	-7.35	-37.50	NA	NA	NA	NA	NA
Rubbermaid	RBD	35.25	32.00	35.00	2.88	8.95	35.25	21.25	.52	.27	-1.76	-33.20	2.61	-.18 Q	-6.1	11.0	6.5
West Co	WST	33.25	27.50	30.88	2.75	9.78	33.25	12.75	.86	-.34	.54	-9.18	2.55	.73 Q	35.4	16.0	6.7

(KEY: NA—Not Applicable NC—Not Calculable NE—Negative Earnings)
Q—First quarter S—Six months N—Nine months F—Fiscal year
**—Other than a quarterly multiple resulting from a fiscal year change*
Table prepared by Media General Financial Services, Richmond, Va. 23261

Financial statements

American Biltrite reported a 1980 net loss of $12,562,000, or $4.78 per share, on sales of $201,732,000. This, in comparison to the previous year's earnings of $5,007,000, or $1.90 per share, on sales of $207,580,000. For its 1980 fourth quarter, net earnings were reported at $339,000 or 13 cents per share, on sales of $49,962,000, compared to fourth quarter 1979's net loss of $1,124,000, or 43 cents per share from sales of $52,043,000.

Consolidated net sales for **Bandag's** first quarter were a reported $79,762,000. Out of that came net earnings of $6,132,000, or 51 cents per share.

Cities Service has declared a 40-cents-per-share dividend, payable June 8 to stockholders of May 11 record.

For the period ended March 31, **Cooper Tire and Rubber** reported record sales of $88.5 million as opposed to first quarter 1980's sales of $60.7 million. Reported net income was $3.2 million, or $1.59 per share, compared to $661,000, or 32 cents per share of last year's equivalent three-month period.

Du Pont reported 1980 sales of $13,652 million that produced a net income of $716 million, or $4.83 per share.

Essex Chemical reported 1980 net earnings of

Summary

P/E	DIVIDENDS			FINANCIAL POSITION					
	Indicated Dvd. Rate			(Last Fiscal Year) in $Millions			(Last Fiscal Year) Per Share		
P/E Ratio Today	Amt.	Yield	Last X Dvd. Date	Revenue	Earnings	Current Ratio	Long Term Debt	Stock Equity	Last Bal. Sheet Date
	$	%		$	$		$	$	
11.4	.00	.0	00-00-00	147.0	1.9	2.3	1.7	3	1280
12.3	.00	.0	06-29-81	59.0	3.9	1.2	.9	6	1279
NE	1.20	3.4	02-26-81	401.3	-16.4	2.5	48.5	59	0980
10.3	.80	3.4	03-17-81	330.9	27.4	3.3	1.2	13	1280
4.4	.90	2.8	06-01-81	324.0	12.8	2.2	27.4	32	1280
NE	.15	8.6	11-18-80	3480.8	.0	1.8	4.5	4	1279
NE	.30	2.5	03-30-81	4850.5	-122.0	1.5	10.4	23	1080
11.5	1.50	5.9	04-29-81	2215.2	40.8	1.9	9.7	40	1180
9.3	1.56	6.0	02-24-81	3079.6	61.7	1.9	31.2	55	1280
6.0	1.30	7.6	05-11-81	8444.0	206.7	2.1	17.3	32	1280
6.0	1.20	4.4	03-02-81	180.7	4.7	2.2	17.2	33	1280
21.8	.00	.0	08-22-78	2299.5	-7.8	2.0	19.8	16	1280
7.7	1.32	6.2	03-10-81	326.4	10.1	3.2	21.1	45	1280
NE	.30	3.1	06-16-81	207.6	3.3	2.3	10.8	21	1279
16.0	.72	1.5	05-15-81	380.8	25.8	2.3	4.6	11	1280
14.8	1.60	5.2	05-21-81	2524.0	95.7	2.1	9.7	28	0680
13.8	.56	4.3	04-01-81	716.4	8.6	2.2	29.9	26	1080
3.8	.00	.0	00-00-00	95.9	5.9	1.7	9.5	15	1279
7.4	.60	3.6	03-10-81	58.3	3.6	2.9	.0	16	1279
10.0	.00	.0	12-24-80	143.9	1.1	1.7	4.7	8	1279
93.8	.00	.0	00-00-00	63.8	.1	1.5	.0	7	1180
NA	.00	.0	00-00-00	NA	NA	NA	NA	NA	NA
12.6	1.08	3.1	05-11-81	308.9	20.1	1.9	2.0	18	1280
11.1	.60	1.9	07-08-81	148.2	9.9	2.[illegible]	3.3	17	1280

All information in this table is based on sources believed to be reliable, but its accuracy is not guaranteed. Every effort will be made to correct errors, when discovered in future editions.

$5,500,000, or $2.30 per share on sales totaling $152,119,000. For its 1981 first quarter, the corporation reported earnings of $931,000, or 35 cents per share produced from net sales of $39,863,000.

Exxon reported fourth quarter 1980 net earnings of $1.35 billion, or $3.12 a share, on sales of $29.85 billion. For the whole year, net income came to $5.7 billion, or $12.99 per share. Sales were reported to be $110.4 billion.

For its 1981 first quarter, Exxon announced an estimated net income of $1,600 million, or $3.70 per share on sales totaling $30,323 million. According to the company, these figures were down 16.9% from $1,925 million or $4.40 per share made from $27,654 million in the 1980 first quarter. In another financial statement, the company declared a $1.50-per-share cash dividend on capital stock, payable June 10 to stockholders of May 15 record. This is the same amount paid out in the first 1981 quarter.

BFGoodrich announced that its 1981 first quarter net income reached $26.3 million, or $1.41 a share, from the $20.3 million, or $1.20 a share reported in the 1980 first quarter. Sales amounted to $780.4 million and $767.5 million for the first three months of 1981 and 1980 respectively.

In another financial statement, the company's board of directors voted to extend the August 15, 1981 expiration date of the company's warrants for purchasing common stock, to August 31, 1982. Issued August 15, 1972, the warrants to purchase 1,500,000 shares of common stock were connected with the $75,000,000 principal amount of debentures issued at that time. In each warrant, the holder is entitled to purchase one share of common stock at $30, subject to adjustment.

Goodyear Tire and Rubber reported first quarter sales of $2,217,685,000 that produced worldwide earnings of $43.1 million, or 59 cents per share. This, compared to first quarter 1980 sales of $2,023,431,000 and earnings of $50.7 million, or 70 cents a share. This reflects a 14.9% drop in profit from last year's first quarter earnings.

In another financial statement, the directors announced a 32.5-cents-per-share regular quarterly dividend, payable June 15 to stockholders of May 15 record. This represents an annual rate of $1.30 a share.

First quarter 1981 earnings for **Gulf Oil** amounted to $303 million, or $1.55 per share, down from the $389 million, or $1.99 per share earnings of 1980's first quarter. Revenues for the three months ended March 31, were reported at $7,874 million. For that period in 1980, sales were $7,753 million restated.

In another financial announcement, the company's directors declared a 62½-cent per share regular quarterly dividend payable June 10 to shareholders of May 1 record.

Hercules' board of directors announced a 30-cents-per-share regular quarterly dividend on common stock, payable June 25 to shareholders of June 5 record.

Mohawk Rubber's first quarter net income of $1,087,000 was an increase of 248% over 1980 first quarter's $312,000. This, on net sales of $40,084,000 and $36,134,000 for first quarters 1981 and 1980 respectively. Earnings per share came to 90 cents over last year's 26 cents.

Reported sales of $83.1 million for **National-Standard's** second quarter of 1981 produced net earnings of $2 million, or 49 cents per share. The second quarter ended March 31. For the first six months ended March 31, net sales amounted to $153.9 million, and net earnings to $3.5 million, or 86 cents per share.

For its first 1981 quarter, **Uniroyal** reported estimated net income of $7.6 million or 24 cents a share from sales totaling $541 million. This compares to the first 1980 quarter that resulted in a $11.7 million loss. Sales for that quarter amounted to $580 million.

U.S. & World Rubber News

Walsh urges SR producers to divest of tire dependence

MADRID — Armstrong Rubber Chairman James Walsh told the International Institute of Synthetic Rubber Producers that it "cannot continue to play hide and seek with the natural rubber industry forever," and "we should aim toward divesting ourselves of our 60% dependence upon the world's tire industry."

Walsh encouraged the group attending the IISRP's 22nd annual meeting, to increase research programs and support innovative people with new ideas who will generate new polymer products.

Although it is not new, Walsh mentioned an enhanced bitumin product used in road pavement, as possibly generating enough tonnage to equal that of tire production. He said this enhanced bitumin could generate millions of kilograms of SBR latex sales, while conserving tens of thousands cubic meters of petroleum asphalt and tar.

Walsh called the potential for the development of latex enhanced asphalt "awesome." He said even though the topic had been discussed a few years ago it should be reexamined, saying, "is it not feasible to explore the possibility of polymer use that would improve the life of a road surface just as it has improved the performance of tires that roll across it."

He said the industry must start putting "some technical muscle behind our less technical daydreams." He said it was time to quit mimicking natural rubber and explore other capabilities.

"Our industry's interest in technology to improve SBR's ability to displace natural rubber has been unimpressive, when it is compared to the natural rubber producers."

Walsh said the synthetic rubber producers are facing a tire industry with estimated growths of about 2% per year through 1990. He said SR producers did not use the "fat years" when they had a captive tire market to explore new markets. He said it was easy for the industry to get this way because many of the major SR producers were tire companies and their own best customers.

The development of black masterbatch technology was significant, Armstrong's chief said because of all the technical and commercial obstacles it overcame.

But recently "our efforts and interests have lain dormant," he told the group. He said perhaps the industry has been held back by insecurity of wondering whether the newer solution polymer technology is going to bury the existing emulsion polymer technology.

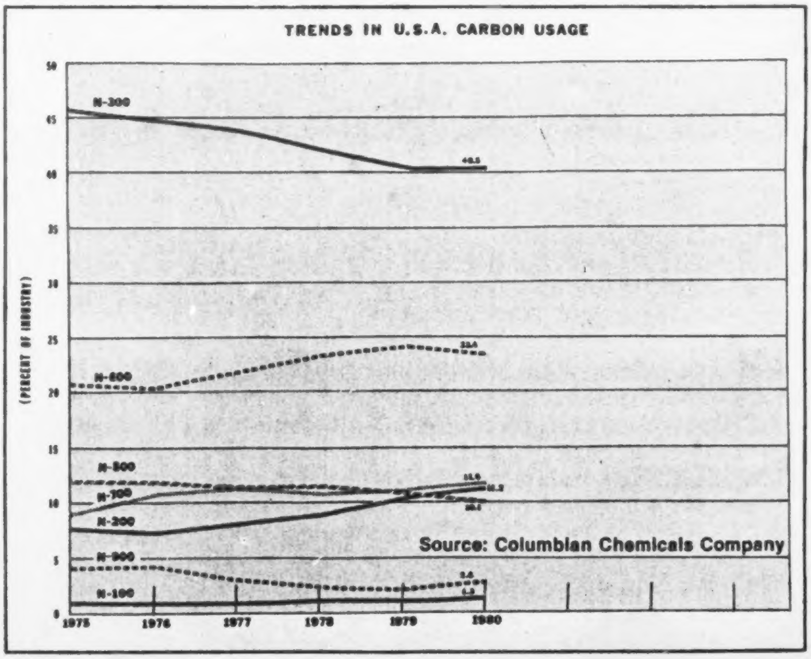
James Walsh

1980 carbon black shipments down 19%

AKRON — Despite a 31% upturn in the fourth quarter, 1980 carbon black shipments from U.S. plants decreased 19% from 1979 to 1,239 thousand metric tons, the lowest in 10 years.

The report from Edward Bosworth, manager of marketing for Columbian Chemicals, shows that exports rose to 79 MMT, their highest level in 12 years. Domestic shipments decreased 20% to 1,160 MMT. Shipments of N-100 series rose 3% and came within 0.1% of its record in 1972. Conversely, N-300 posted its worst year since 1971 and N-500 shipments were the weakest since 1963.

U.S. plant inventories of furnace blacks diminished from 108 MMT to 76 MMT, a 3⅓ week supply, varying from 2½ weeks of N-600 to over six



Source: Columbian Chemicals Company

weeks of N 100.

The consumption of dry rubber hydrocarbon decreased 21% to 2,272 thousand metric tons, the lowest since 1967. All polymers were down, from 8% in Butyl to 24% in SBR. Consumption for natural rubber was the worst since 1971. The last year SBR consumption was lower was 1963.

The synthetic ratio remained unchanged at 76% while the carbon-rubber ratio increased from 50.8 to 51.1 parts per hundred.

SBR black rubber production decreased 28% to 337 MMT. Oil loadings into black rubber declined for the third consecutive year, from the record 45.9 phr in 1978 to 40.8 phr. Both the 23.3% of net rubber share of dry SBR and the 111 MMT of carbon black used in black rubber dipped to their lowest level since the early sixties. Table 1 shows how 1980 affected the compounded rate of change during the past decade and the past five years.

Goodyear cutting IR Semperit, Conti adding

AKRON — While Goodyear announced it was phasing out certain industrial products manufacturing in its Akron plant, Semprit and Continental said they were increasing lines and production.

Goodyear's Akron facility manufactures miscellaneous conveyor belting, custom built hose, air springs, air sleeves, tank linings and a variety of extruded rubber and specialty goods. Approximately 500 hourly and salaried employees are affected.

Hoyt Wells, a Goodyear vice president, said studies are under way to determine whether certain product lines could be made more cost competitive in other locations or if some should be discontinued. Wells said the decision does not affect Goodyear's plan for a new mixing center in Akron.

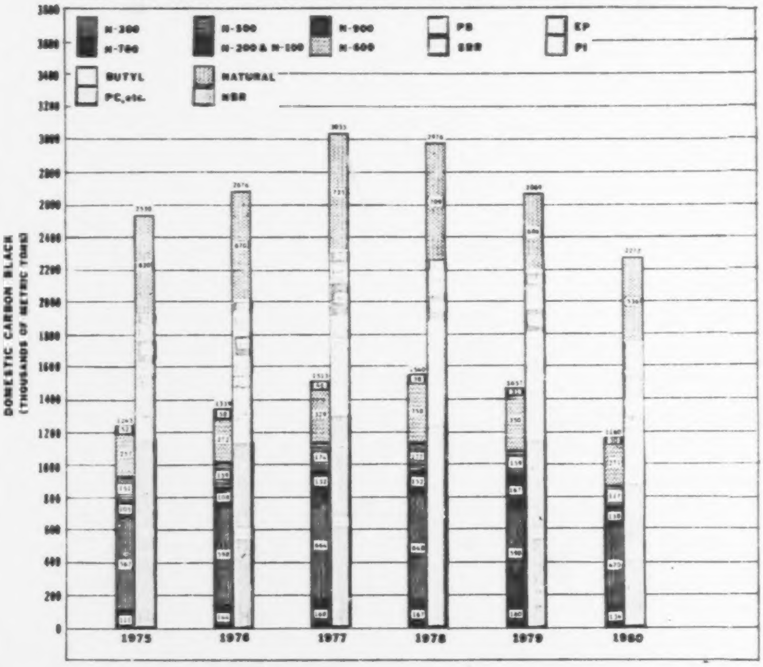
The Austrian based Semperit is undergoing a $50 million improvement program which involves the purchase and installation of new machinery, automation of existing production processes and to implement new quality control systems. Semperit tripled its U.S. sales and marketing staff where it expects much of the benefits from its investment.

Frants Becker of Semperit of America said "we intend to make

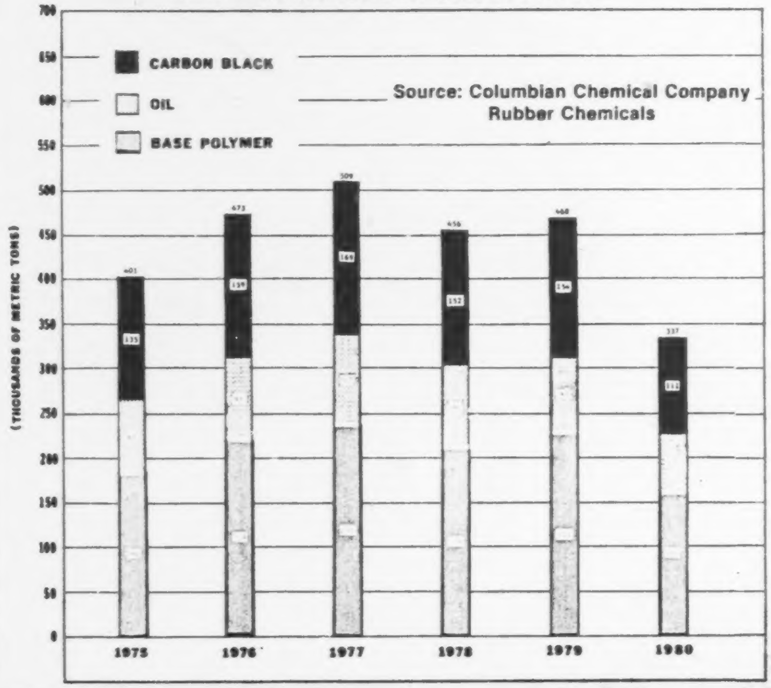
TABLE 1 Annual change in the U.S.A.

	1979-80	1975-80	1979-80
Carbon Black Shipments (Incl. Exports)	+0.1%	−0.6%	−18.6%
Domestic Carbons	0	−1.4%	−20.4%
Dry Rubber Hydrocarbon	−0.2%	−2.2%	−20.8%
SBR Black Rubber Production	−3.7%	−3.4%	−28.1%
Oil into Black Rubber	−4.1%	−4.4%	−28.7%
GNP (in 1972 dollars)	+3.2%	+3.3%	−0.2%
Car Production	−0.3%	−0.9%	−24.3%
Truck Production	−0.3%	−5.3%	−46.3%

U.S.A. DRY RUBBER HYDROCARBON & CARBON BLACK CONSUMPTION



SBR BLACK RUBBER PRODUCTION



Source: Columbian Chemical Company Rubber Chemicals

Semperit of America the leading industrial rubber importer in the U.S." Becker indicated that areas targeted for growth are specialty hoses and conveyor belts.

Continental Gummiwerke of West Germany is also expanding its line of industrial products to reach the U.S. It has added steelcord and fabric conveyor belt up to 120" wide, hydraulic and other industrial hoses, v-belts, printing blankets, air springs, hard rubber and medical products.

Continental Products, Conti's U.S. distributor previously handled only passenger car and motorcycle tires in the U.S. Peter Meier, the man responsible for expanding Conti's industrial products share in the U.S. market says the company will show it is equally competitive with industrial products as it is in tires.

Wright grinding rolls 5-10 times faster

WATERTOWN, MA — Wright Industrial Rubber Roll Company, Inc., Watertown, Massachusetts, grinds and refinishes a wide variety of nonmetallic rolls ranging in size from small rolls used in office equipment up to giant 16" diameter, 190" long rolls used in various applications such as plastics plants, textile and paper mills, and canneries. Durometers, according to Richard Odell, Wright's president, range from 15 to 100 shore A.

About six months ago, Wright installed a unique new roll grinding machine. The Series 16 Roll Grinder, manufactured by South Bend Lathe, features two independent variable speed drives — one to turn the roll and the other to traverse the grinding head the length of the roll. While the tungsten carbide coated grinding wheel can operate either wet or dry, Wright's machine is used wet.

The results have been dramatic. In fact, Odell says that since installing the new South Bend roll grinder, grinding time per roll has been decreased 80% to 90%, depending on type or roll material, durometer, number of same-size rolls, and other variables. Total production time including trimming, finishing, washdown, emptying filter, etc., has been reduced from 1/2 to 1/4 of the time.

Prior to installation of the new specialized roll grinder, Wright had been dry grinding with a standard lathe with a grinder attachment. Smoke, dust, and an imminent fire hazard seemed to be inherent in the operation. Wet grinding with the new machine has virtually eliminated those problems. "In fact," said Odell, "the entire operation is a much cleaner and safer process for the operator than with conventional dry grinding."

In addition to improving the environment, working conditions, and vastly improving productivity, Odell says the machine delivers a much better finish on most rolls grounds, and they expect to be able to achieve this on all rolls with some additional experimentation on speeds and feeds for certain roll durometers. He added that the finer finish the machine imparts to the roll has resulted in a significant reduction in secondary finishing and polishing operations.

One unique feature of Wright's roll grinder installation is in mounting the coolant tank and filter below floor level, which significantly reduced the amount of floor space needed. A cover over the coolant tank is operated hydraulically for easy access to the filter.

"We have found this machine to be accurate within .002" for all rolls ground to date," Odell says. And, in addition to much high refinishing rates, the machine saves time in another way. "We have been able to eliminate the lining-up procedure that was necessary with our other equipment when going from either different lengths or different durometers of rolls ground," Odell said.

In addition to the Series 16, a smaller Nordic 15 Roll Grinder is available for roll diameters up to 7½" and maximum grinding lengths of 36" or 56".

RMA monthly tire report

(Figures in Thousands of Units)

	January 1981				
	Shipments				
Pneumatic Tires	Original Equipment	Replacement	Export	Total	Production
Passenger	2,700	9,649	346	12,695	12,548
Radial	2,250	6,297	207	8,754	7,679
Truck & Bus	528	2,267	132	2,927	2,915
Radial	119	633	15	767	506
Motorcycle	20	120	3	143	70
Tractor-Implement	137	242	14	393	383
Industrial & Utility	551	168	14	773	659

	February 1981				
	Shipments				
Pneumatic Tires	Original Equipment	Replacement	Export	Total	Production
Passenger	2,696	8,497	380	11,573	12,802
Radial	2,244	5,082	175	7,501	7,874
Truck & Bus	510	2,040	200	2,750	2,839
Radial	107	594	25	726	513
Motorcycle	19	81	6	106	79
Tractor-Implement	139	234	18	391	403
Industrial & Utility	570	159	12	741	677

Imports for consumption of tires

Source: U.S. Department of Commerce Report No. IM-146

(Figures are rounded and expressed in Thousands)

	Pneumatic Tires New					
	Passenger Car		Truck & Bus		Motorcycle	
	Net Quantity	Value (Dollars)	Net Quantity	Value (Dollars)	Net Quantity	Value (Dollars)
1980						
Jan.	1,208	44,899	405	55,566	151	1,957
Feb.	1,107	42,352	364	51,982	92	1,142
Mar.	1,238	46,890	407	57,832	179	3,015
April	981	35,596	477	62,924	174	2,271
May	964	35,883	350	51,346	141	1,988
June	1,043	39,530	372	53,132	146	2,064
July	1,123	37,889	301	42,016	174	2,031
Aug.	992	27,194	242	29,586	126	1,264
Sept.	888	23,443	260	31,404	80	1,003
Oct.	855	25,168	329	34,777	152	2,043
Nov.	981	28,573	356	44,225	111	1,618
Dec.	2,363	82,789	392	48,257	157	2,593
Cum.	13,743	470,206	4,255	563,047	1,683	22,989
1981						
Jan.	2,087	68,424	391	47,440	174	2,681
Feb.	1,305	44,292	334	47,579	121	1,906
Cum.	3,392	112,716	725	95,019	295	4,587

Specialty polymers

Tailor-made elastomers spark steady growth

by David L. Schultz, Editor

EPDM, Nitrile, Neoprene, Butyl, Fluoroelastomers and Silicone comprise a group of rubbers pegged for steady growth due to specialized applications. These synthetic elastomers are organic polymers capable of being tailored to particular uses which can more than justify the cost/performance ratio.

While it is no doubt true that business for the SR producer in the immediate future promises to get tougher as new challenges are presented — containing costs and coping with increased competition — wider opportunities for market penetration still exist. The percentage growth of special-purpose SRs will continue to outstrip that of the general-purpose rubbers such as SBR, polybutadiene, polyisoprene and the styrene thermoplastics.

According to C.F. Ruebensaal (IISRP), in the SR industry there are some "high growth areas, most notably the special-purpose rubbers which are growing at 10%, 15% and 20% per year as opposed the standard large-volume rubbers which are growing at 2%, 3% and 4% per year." In short, changing technical requirements in many end uses — in cars, trucks and buses — will favor the development and uptake of specialty elastomers, even though these will be competing to greater or lesser degree with plastics.

At the present time, specialty elastomers account for some 15% of total rubber consumption.[1] Four rubber types account for the major share of this percentage figure. According to R.J. Bachmann, "the most important one is butyl rubber (IIR), of which approximately 410,000 tons are consumed annually. Next comes ethylene-propylene rubber with an annual consumption which has reached 360,000 tons." Next comes chloloprene rubber (CR) and last, there is acrylonitrile-butadiene rubber (NBR) with a consumption figure of approximately 200,000 tons per year. In spite of their relatively high prices, these rubbers are finding increased usage in applications where good vulcanization properties must be supplemented by tailored characteristics.

One of the main reasons for the positive development of specialty polymers is their adaptability to a wide variety of environmental conditions. For example, EPDM has excellent resistance to such factors as weather, ozone and oxidation; it has good tensile strength and high resistance to heat. In addition, it is able to accept high oil-black loadings and is also characterized by processing ease (mixing, extruding, molding).

A promising future for EPDM, for example, has recently opened up with the development of a variety of new outlets in automotive trims, boating accessories, construction materials and consumer products. Most of these new outlets have become possible as producers learned to modify the base polymer using new catalyst systems to tailor-make rubbers for specific applications. Research emphasis has been on maintaining the polymer's high impact resistance while building in more plastic-like properties.

Specialized applications

Additional application areas demanding tailored performance characteristics provided by specialty polymers include offshore oil fields, the coal mining industry, automobiles and bridge construction. In view of these increasingly-sophisticated applications, specialty rubbers are expected to show an above-average growth rate.

Polychloroprene (Neoprene) is one of the most versatile synthetic elastomers due to its high resistance to abrasion, superior tensile strength and resilience and high resistance to oils and solvents. This elastomer finds its major applications in automotive and other mechanical goods, as a bonding agent in nonwoven textiles, in wire and cable, in hose and belting and in miscellaneous products which require good flame resistance.

Mixes prepared from polychloroprene polymers exhibit excellent extrusion and calendering properties thus improving output, surface aspect and dimensional stability of the extrudates — low shrinkage on calendering, low die swell, good resistance of profiles to collapse and distortion. Easily-adaptable to a number of processing techniques, the high Mooney viscosity of polychloroprene also imparts a high compatibility with loading materials and plasticizers. These mixes possess rheological characteristics which make easier calendering and extrusion.

Acrylonitrile butadiene rubbers also provide improved productivity as a result of processing ease. In mill mixing these polymer compounds blend rapidly and smoothly and are

Indexes of Average Manufacturers Prices of Selected Synthetic Elastomers 1970-1979
1967 = 100

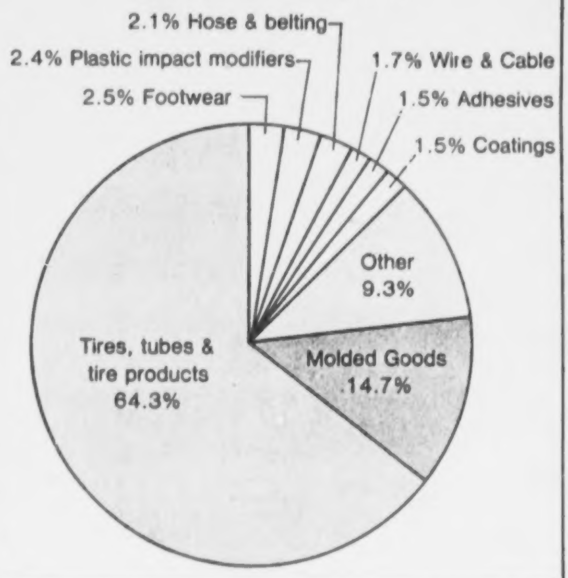
	Styrene-butadiene	Nitrile	Stereo-specifics	Urethanes	Silicones	Total
1970	104.5	101.5	95.1	98.3	94.3	100.7
1971	90.9	98.7	91.2	106.6	81.1	95.9
1972	90.9	95.3	97.1	116.4	71.0	98.9
1973	72.7	95.7	104.8	109.0	66.1	92.6
1974	109.1	108.7	142.9	119.0	73.8	122.2
1975	122.7	123.9	142.9	130.0	93.5	137.0
1976	121.3	132.5	172.2	128.9	89.0	153.8
1977	150.0	140.0	165.8	134.0	87.2	171.6
1978	127.2	146.5	175.6	136.0	100.0	194.0
1979	154.5	157.3	204.8	152.0	103.5	216.4

Source: Calculated from data of "Synthetic Organic Chemicals," C.H. Kline

U.S. Exports of Synthetic Elastomers 1977-1979

	1977	1978	1979
Million lb			
SBR	165	180	196
Butyl	72	84	93
Nitrile	24	20	21
Stereo-specific			
Cis-polyisoprene	13	10	12
Cis-polybutadiene	27	33	40
EPDM	40	52	68
Other	213	207	213
	554	586	643
$ Million			
SBR	$ 26	$ 59	$ 99
Butyl	33	40	76
Nitrile	14	13	21
Stereo-specific			
Cis-polyisoprene	6	5	6
Cis-polybutadiene	9	13	27
EPDM	21	30	49
Other	190	123	138
	$299	$283	$416

Sources: "U.S. Exports, FT410"; and "Current Industrial Reports, M30A."


U.S. consumption of synthetic rubber by major end use (1979)

readily combined with other compounding ingredients. Another advantage of acrylonitrile butadiene compounds is in the injection and compression molding processes where there are excellent flow characteristics, easy removal of vulcanizates from molds and negligible mold fouling.

Due to their excellent non-metal corrosion and water resistance, these elastomers are recommended for use in oil-resistant hoses, packings, gaskets, oil seals, diaphragms, printing rolls, spinning cots as well as similar specialized applications. In order to cope with air pollution caused by auto exhaust fumes, for example, the reduction or elimination of lead from some grades of gasoline continues to be a dominant trend. Thus aromatics in gasoline have been increased to maintain octane ratings.

As a result of these increased aromatics, conventional rubbers can not be used for fuel hose. Acrylonitrile butadiene rubbers have been developed to meet these demanding conditions. The superior cut life of these polymers is a result of blending techniques — in particular, a special type of high acrylonitrile liquid polymer to a modified high acrylonitrile NBR.

Butyl rubber is a copolymer of isobutylene with under 3% isoprene. Its outstanding properties include low permeability to gases and excellent tear and aging resistance. As a result of its low permeability to gases, approximately 80% of all butyl rubber consumed is used in inner tubes.

The development of the tubeless tire resulted in a temporary decline in the use of butyl rubber; but in the last few years it has found a number of other applications in inner liners, inflatable sporting goods and liners for reservoirs and grain silos. Other applications include automotive mechanical goods, and architectural and industrial sealants. Its use in wire and cable continues to be impacted by plastics.

As a result of its impermeability to gas, butyl rubber has found its major outlet in auto tires as well as miscellaneous tailored industrial applications. While this polymer has been traditionally priced at 35% to 40% above SBR and only slightly below EPDM, its relative cost depends on isobutylene prices and to a lesser degree on those of isoprene; and its production totaled 427 million lbs. in 1979.

More specialties

In 1979, approximately 1,212 million lbs. of such specialty elastomers as chlorosulfonated polyethylenes, polysulfides, fluorocarbons, polyacrylates, polyurethanes and silicones were produced in the U.S. All of these synthetic rubbers are relatively high priced and used almost exclusively in specialty applications.

U.S. Production and Shipments of Synthetic Elastomers 1970-1980

	Production, million 1b-a	Merchant shipments		Total shipments, $ million
		Million 1b	$ Million	
1970	4,438	3,820	$1,032	$1,114
1971	4,616	4,013	1,034	1,153
1972	4,914	4,136	1,095	1,289
1973	5,990	5,159	1,297	1,397
1974	5,742	4,667	1,608	1,862
1975	4,579	3,948	1,458	1,820
1976	5,386	3,710	1,529	2,204
1977	5,813	4,177	1,940	2,360
1978	5,761	3,640	1,875	2,287
1979	5,860	4,002	2,325	2,835
1980-e	5,980	4,090	2,605	3,175

2,835-e

a — Elastomer content only.
e — Estimates.

Sources: "Syntnetic Organic Chemicals"; "Annual Survey of Manufactures"; and estimates by C.H. Kline & Co.

U.S. Production and Merchant Shipments of Synthetic Elastomers by Type of Product 1969 and 1977-1979

	Production, Million 1b				Merchant shipments					
					Million 1b			$ Million		
	1969	1977	1978	1979	1977	1978	1979	1977	1978	1979
SBR	2,530	3,254	2,994	3,057	1,925	1,528	1,690	$ 644	$ 428	$ 583
Stereo-specific										
Polybutadiene	597	758	802	727	544	317	403	183	114	171
EPDM	167	349	386	389	298	324	352	148	177	213
Polyisoprene	244	137	+	+	+	+	+	+	+	+
	1,008	1,244	1,188+	1,116+	842+	641+	755+	341+	291+	384+
Butyl	291	329	340	427	+	+	+	+	+	+
Nitrile	154	161	161	161	135	123	125	88	84	91
Urethane	27	92	112	114	79	97	93	106	131	142
Silicone	14	53	78	89	43	67	76	127	244	265
Other-a	466	771	999	1,009	1,183	1,245	1,311	727	808	977
TOTAL	4,490	5,904	5,872	5,973	4,207	3,701	4,050	$2,033	$1,986	$2,442

+ — Additional amounts included in "other" elastomers.

a — Includes: polychloroprene, chlorosulfonated polyethylene, polysulfide, silicone, fluorocarbon, thermoplastic rubber and miscellaneous elastomers.

Sources: "Synthetic Organic Chemicals" and estimates by C.H. Kline & Co.

Polyurethanes are produced in the largest volume but silicones account for the greatest percentage of dollar shipments. Prices of synthetic elastomers have recently been exhibiting a strong upward trend as a result of petrochemical feedstock cost/availability fluctuations. Overall price increases have averaged 8.9% annually since 1970. Stereo grades increased the greatest at about 9% while silicones the least at 1.0% per year.

Thermoplastic elastomers are also generally-classified as specialties. Their main advantage is that they can be processed in plastic molding equipment without the need for vulcanization; thus production costs are substantially lowered. In 1980, domestic consumption of thermoplastic resins is estimated at 190 million lbs., valued at almost $150 million.

Ranked by consumption importance, thermoplastic elastomers include styrene block copolymers mainly for footwear; polyurethanes for fabric coatings and for injection-molding and extrusion applications; olefin elastomers primarily for exterior auto components and copolyesterethers for wire and cable, hose and injection moldings. Consumption of thermoplastics is forecast to grow by almost 15% per year through 1985.

Future developments

As with other areas of the rubber industry in general, if the specialty polymer sector is to realize its true growth potential, a more effective effort must be expended to develop new uses for elastomers which can be made possible by the new polymer technologies currently being created. Unless more of this is done — aimed at the replacement of metal, plastics or fulfilling entirely new market needs — the specialty polymer industry may not be able to afford to continue the research and development expenditures needed to develop new materials. The SR industry in general is being severely impacted by a number of factors including feedstock price/availability, environmental considerations and potential health hazards (see *RW,* Feb. 1981, "Synthetic Rubber: Profile of an Industry").

In short, future developments in the specialty elastomer field will be determined by energy costs, safety factors and environmental protection. But in each of these areas, as the technology becomes increasingly sophisticated the requirements made on the materials used will also become increasingly sophisticated and specialized. **RW**

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Rubber World
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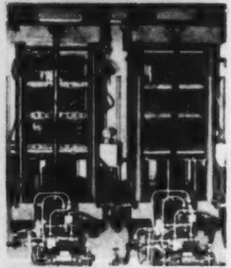

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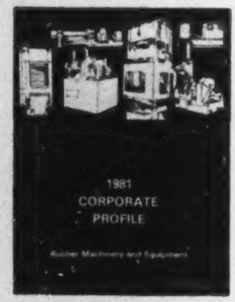

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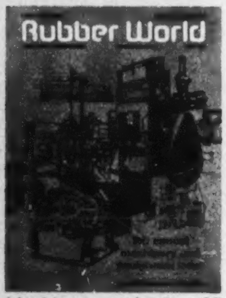

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Cover sketch done by Connie Ross, *RW* art director.

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Rubber World Stock

		PRICE							TREND TO MARKET				EARNINGS/SHARE				
					Change		52 Week		Price Trend (% per day)		Volume Trend (% per day)			Latest 12 Months vs Preceding 12 Months Change			
Name	Symbol	High	Low	Close	Amt	Pct	High	Low	Last 30 Days	Last 5 Days	Last 30 Days	Last 5 Days	Last Fiscal Year	Amt	Pct	5 Year Annual Growth Rate	Profit Margin
		$	$	$	$	%	$	$	%	%	%	%	$	$	%	%	%
Tires and Inner Tubes																	
Aegis Corp	AO	3.13	2.75	2.88	-.25	-8.00	3.25	1.38	59	11	-2.25	-3.38	18	-.04 Q	-14.8	-5.0	1.3
Alliance Tire	ATRA	15.38	13.13	15.38	2.25	17.14	15.38	7.25	84	75	-9.11	56.25	1.43	97 Q	236.5	104.0	6.2
Armstrong Rub	ARM	38.63	36.00	36.00	-2.13	-5.57	39.88	16.13	24	-.16	-3.52	-4.45	-10.17	-12.73 S	-256.1	-39.0	-4.1
Bandag Inc	BDG	26.88	21.75	26.88	4.88	22.16	26.88	16.63	40	1.79	4.74	5.54	2.27	24 Q	11.5	12.0	8.3
Cooper Tire	CTB	37.75	32.63	37.75	3.88	11.44	42.00	9.63	47	2.49	70	-8.08	6.17	5.09 Q	226.2	12.0	4.0
Dunlop Holding	DLP	1.75	1.56	1.69	-.06	-3.57	1.94	1.31	-.10	00	-3.37	-63.89	-.02	-.51 S	-118.6	-21.0	0
Firestone Tire	FIR	13.13	11.75	12.38	63	5.32	13.38	6.63	49	-.08	1.37	1.92	-2.11	78 S	NE	-41.0	-2.5
Gen Tire	GY	29.00	25.88	28.50	2.00	7.55	29.00	14.69	62	62	1.94	-13.53	1.65	-.05 Q	-2.2	-20.0	1.6
Goodrich B F	GR	26.00	24.63	25.88	63	2.48	28.13	18.88	-.12	1.17	1.44	21.03	3.57	-2.09 Q	-42.7	21.0	2.0
Goodyear Tire	GT	19.75	17.63	19.75	1.88	10.49	20.25	13.00	16	3.18	35	8.09	2.85	96 Q	51.8	7.0	2.4
Mohawk Rub	MWK	18.38	15.00	16.13	-.97	-5.67	23.75	6.75	-.21	-2.58	2.66	12.39	2.57	2.36 Q	374.6	-3.0	2.6
Uniroyal Inc	R	9.75	8.38	9.25	63	7.25	9.75	3.50	62	-.53	-1.37	-17.09	-.29	5.56 Q	NE	-93.0	-.3
Rubber Products																	
Amerace Corp	AAE	24.38	21.25	22.00	.63	2.92	25.25	18.25	.26	-1.00	.75	-51.09	2.84	-.77 Q	-21.6	4.0	3.1
Am Biltrite	ABL	9.50	8.75	9.13	-.50	-5.19	11.88	5.88	-.34	.45	1.77	6.82	-4.78	-5.33 Q	-658.0	NE	.2
Carlisle Corp	CSL	51.88	46.50	48.50	-.38	-.77	4.75	15.94	.26	.03	.46	-25.09	2.78	.80 Q	36.3	43.0	6.8
Dana Corp	DCN	33.50	30.13	32.88	2.50	8.23	33.50	20.13	.23	1.08	1.28	30.90	2.78	-2.88 Q	-57.9	-6.0	3.8
Dayco Corp	DAY	12.88	11.63	12.88	.75	6.19	14.38	10.38	-.03	1.22	2.28	-13.75	1.10	-.96 S	-51.3	-11.0	1.2
Grt Amer Ind	GRI	16.50	15.50	16.25	.50	3.17	18.88	8.13	.16	.88	-2.51	-12.50	4.08	-.02 Q	-.5	24.0	5.6
OSullivan Cp	OSL	17.50	17.00	17.25	-.25	-1.43	17.63	7.88	.10	.29	-3.55	-90.00	2.18	.44 Q	23.9	8.0	6.7
Pantasote Inc	PNT	5.63	4.25	5.63	1.25	28.57	6.25	2.84	.04	3.56	1.66	12.59	.30	.10 Q	28.5	-18.0	.8
Plymth Rub A	PLRA	7.50	5.25	7.50	2.13	39.53	7.63	2.25	.76	3.67	6.86	-2.22	.02	.10 Q	NE	NE	.2
Plymth Rub B	PLRB	7.00	4.63	6.25	1.25	25.00	7.38	1.63	.28	1.72	8.80	-13.30	NA	NA	NA	NA	NA
Rubbermaid	RBD	39.50	33.50	36.00	2.00	5.88	39.50	21.25	.28	.02	1.32	-49.16	2.61	-.18 Q	-6.1	11.0	6.5
West Co	WST	32.25	28.38	29.00	-3.00	-9.38	33.25	13.25	-.37	.26	-3.05	-41.44	2.55	.73 Q	35.4	16.0	6.7

(KEY: NA—Not Applicable NC—Not Calculable NE—Negative Earnings)
Q—First quarter S—Six months N—Nine months F—Fiscal year
**—Other than a quarterly multiple resulting from a fiscal year change*
Table prepared by Media General Financial Services, Richmond, Va. 23261

Financial statements

American Biltrite said its 1981 first quarter produced net earnings of $1,709,000, or 65 cents per share, on net sales of $53,713,000. The company also reported that a $.075 per share common stock cash dividend will be paid July 15 to stockholders of June 22 record.

Reported sales for **Armstrong Rubber's** second quarter, ended March 31, came to $146,332,000, producing earnings of $4,825,000, or $2.39 per common share. For the six months ended March 31, earnings amounted to $8,844,000, or $4.57 on sales of $256,160,000. These results include that of Copolymer Rubber and Chemical's second quarter sales.

In another financial statement, the company's directors announced a dividend of 35 cents per share for shareholders, on the outstanding common stock. It is payable July 1 to those of June 5 record.

Bandag declared a regular quarterly dividend of 20 cents per share, payable July 22 to shareholders of record June 22.

Bayer AG's operating subsidiaries in the United States reported 1980 consolidated net sales of $2.4 billion, a 14% increase over 1979's $2.1 billion. The U.S. subsidiaries, all of which are held by Rhinechem of New York City, include: Mobay Chemical, Mile Laboratories, Cutter Laboratories, Helena Chemical, Harmon Colors

Summary

P/E	DIVIDENDS			FINANCIAL POSITION					
	Indicated Dvd Rate			(Last Fiscal Year) in $Millions			(Last Fiscal Year) Per Share		
P/E Ratio Today	Amt	Yield	Last X Dvd Date	Revenue	Earnings	Current Ratio	Long Term Debt	Stock Equity	Last Bal Sheet Date
	$	%		$	$		$	$	
12.5	.00	.0	00-00-00	147.0	1.9	2.3	1.7	3	1280
11.1	.00	.0	06-29-81	62.8	3.9	1.2	.7	5	1280
NE	1.40	3.9	06-01-81	401.3	-16.4	2.5	48.5	59	0980
11.6	.80	3.0	06-16-81	330.9	27.4	3.3	1.2	13	1280
5.1	.90	2.4	06-01-81	324.0	12.8	2.2	27.4	32	1280
NE	.15	8.9	11-18-80	3480.8	0	1.8	4.5	4	1279
NE	.30	2.4	03-30-81	4850.5	-122.0	1.5	10.4	23	1080
12.9	1.50	5.3	04-29-81	2215.2	40.8	1.9	9.7	40	1180
9.2	1.56	6.0	06-01-81	3079.6	61.7	1.9	31.2	55	1280
7.0	1.30	6.6	05-11-81	8444.0	206.7	2.1	17.3	32	1280
5.4	.90	5.6	06-01-81	180.7	4.7	2.2	11.5	22	1280
23.7	.00	.0	08-22-78	2299.5	-7.8	2.0	19.8	16	1280
7.9	1.32	6.0	06-09-81	326.4	10.1	3.2	21.1	45	1280
NE	.30	3.3	06-16-81	207.6	3.3	2.3	10.8	21	1279
16.2	.72	1.5	05-15-81	380.8	25.8	2.3	4.6	11	1280
15.7	1.60	4.9	05-21-81	2524.0	95.7	2.1	9.7	28	0880
14.1	.56	4.3	06-30-81	716.4	8.6	2.2	29.9	26	1080
4.1	.00	.0	00-00-00	95.9	5.9	1.7	9.5	15	1279
7.6	.60	3.5	03-10-81	58.3	3.6	2.9	.0	16	1279
12.5	.00	.0	12-24-80	148.7	1.2	1.6	3.9	8	1280
125.0	.00	.0	00-00-00	63.8	.1	1.5	.0	7	1180
NA	.00	.0	00-00-00	NA	NA	NA	NA	NA	NA
13.0	1.08	3.0	05-11-81	308.9	20.1	1.9	2.0	18	1280
10.4	.60	2.1	07-08-81	148.2	9.9	2.1	3.3	17	1280

ll information in this table is based on sources believed to be reliable, but its accuracy is not uaranteed. Every effort will be made to correct errors, when discovered in future editions.

Corp., and Haarmann & Reimer.

Group sales for **Ciba-Geigy's** 1980 fiscal year were reported to be $6.12 billion, with operating profit totaling $157 million.

Sales for **Dayco's** 1981 first quarter, ended January 31, were reported at $182,692,000, producing a net profit of $1,237,000. Per share primary earnings came to 21 cents; fully diluted, 19 cents.

Eagle-Picher Industries reported $139.5 million in sales for its 1981 first quarter, ended February 28. Reported net income of $5 million was equal to 50 cents per share. In another statement, the company recently announced that regular quarterly dividends on the company's convertible preference shares would be payable July 2 to shareholders of June 5 record.

Englehard Minerals and Chemicals reported fourth quarter 1980 sales of $7.74 billion that produced a net income of $125.2 million, or $1.82 a share fully diluted; and 1980 sales of $26.57 billion that made reported record earnings of $532.7 million, or $7.75 a fully-diluted share.

For its 1981 first quarter, the corporation said its net fell 46% from its record earnings of a year earlier. It reported sales of $6.4 billion that amounted to a net income of $76 million, or $1.10 a share fully diluted.

For the year ended November 30, 1980, **Ex-Cell-O** reported earnings of $50.4 million, or $4.91 a share from sales of $1.02 billion. Fourth quarter earnings of $15.4 million, or $1.49 a share came from sales of $285.6 million.

Goodyear Canada reported 1980 consolidated net sales of $493,116,000 that produced a consolidated net income of $14,827,000, or $5.73 per share. The company's 1980 fourth quarter resulted in sales of $128,168,000 and earnings of $5,321,000.

Lubrizol's 1980 revenues of $922,697,000 produced a net income of $111,511,000, or $5.74 per share. Fourth quarter 1980 revenues of $231,633,000 made a net income of $24,731,000, or $1.27 per share.

For its 1981 first quarter, Lubrizol reported revenues of $224,120,000 producing a net income of $18,885,000, or 97 cents per share.

Martin Marietta's 1980 sales of $2,619,327,000 produced net earnings of $188,133,000, or $7.55 per common share.

Mobay Chemical, a U.S. subsidiary of Bayer AG, reported 1980 net sales of $1.07 billion, with income before taxes amounting to $63.2 million and income after taxes to $54.1 million.

For the year 1980, **Myers Industries** reported net income of $3,395,626, or $2.19 per share, on net sales of $67,472,624. For its 1980 fourth quarter, the company reported net income of $1,116,467, or 72 cents per share, on net sales totaling $20,462,170.

In first quarter 1981 results, net income came to $677,232, or 44 cents per share, on sales of $15,876,543.

Fourth quarter 1980 profits from **Rubbermaid's** continuous operations came to $4.9 million, or 64 cents a share on sales of $76.4 million. The 1980 net sales for Rubbermaid's continuing operations totaled $309 million. Reported net earnings from continuing operations came to $20.1 million, or $2.61 per share.

Earnings from Rubbermaid's continuing operations in the 1981 first quarter were reported at $6.2 million, or 80 cents a share, on sales of $82.7 million. For the three months ended March 31, net sales totaled $82,679,000 and produced net earnings of $6,165,000, or 80 cents per common share.

The 1980 net sales for **Sumitomo Chemical** were reported to be $3.3 billion, with net income at $47 million. (U.S. dollar/Japanese yen conversion: $1.00 = ¥203.80.)

CC closes plant; black prices drop

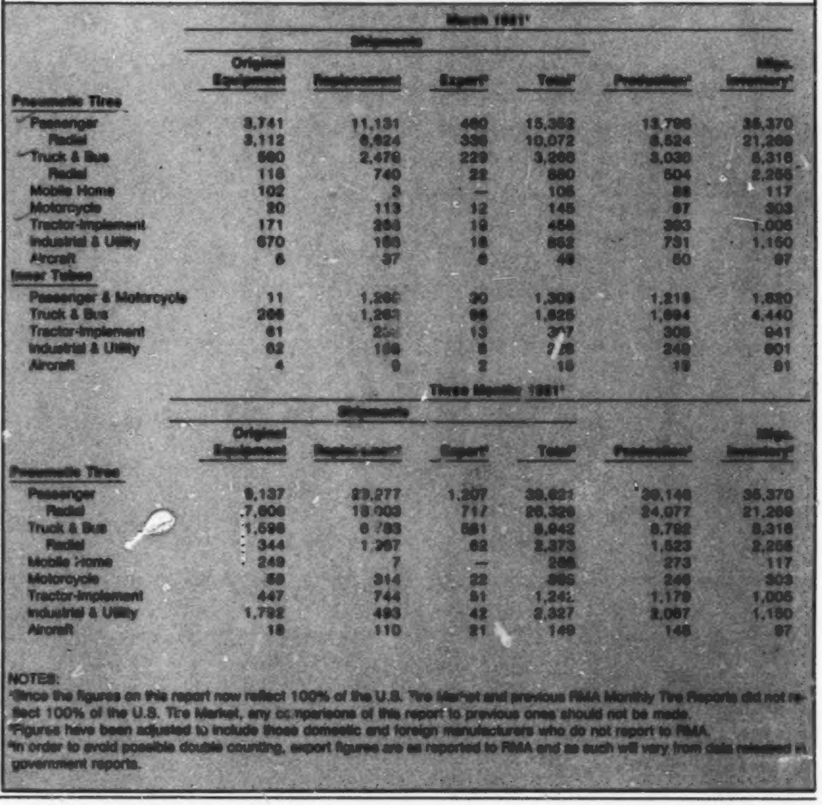
AKRON — Continental Carbon closed its Westlake, LA carbon black plant and has accepted an offer to sell the facility. Continental also announced that is was following the lead of other black producers and decreased its prices by 1½ cents per pound.

Reduction of carbon black oil by suppliers has led to the price reduction by black producers but it is seen as only a temporary situation. Companies that have announced price reductions are J.M. Huber, Cities Service, Cabot and Continental.

C.M. McGuire, Huber's carbon black marketing manager, said that the CBO reduction is temporary and experience says the oil price will return to its former level and perhaps climb even higher. Huber is granting its reduction only to August 31.

Continental said it doesn't expect any problems in meeting customer commitments as a result of the plant closing. The company plans to consolidate manufacturing operations.

RMA monthly tire report
(Figures in Thousands of Units)



March 1981[1]

	Shipments					
	Original Equipment	Replacement	Export[3]	Total[2]	Production[2]	Mfgs. Inventory[2]
Pneumatic Tires						
Passenger	3,741	11,131	460	15,332	13,796	35,370
Radial	3,112	6,624	336	10,072	8,524	21,269
Truck & Bus	560	2,476	229	3,265	3,030	8,316
Radial	118	740	22	880	504	2,256
Mobile Home	102	3	—	105	88	117
Motorcycle	20	113	12	145	87	303
Tractor-Implement	171	268	19	458	393	1,006
Industrial & Utility	670	166	16	852	731	1,150
Aircraft	6	37	6	49	60	97
Inner Tubes						
Passenger & Motorcycle	11	1,268	30	1,309	1,218	1,820
Truck & Bus	266	1,263	96	1,625	1,694	4,440
Tractor-Implement	61	233	13	307	306	941
Industrial & Utility	62	156	8	226	249	601
Aircraft	4	9	2	15	19	81

Three Months 1981[1]

	Shipments					
	Original Equipment	Replacement[3]	Export[3]	Total[2]	Production[2]	Mfgs. Inventory[2]
Pneumatic Tires						
Passenger	9,137	29,277	1,207	39,621	30,146	35,370
Radial	7,606	18,003	717	26,326	24,077	21,269
Truck & Bus	1,598	6,783	561	8,942	8,792	8,316
Radial	344	1,967	62	2,373	1,523	2,256
Mobile Home	249	7	—	256	273	117
Motorcycle	50	314	22	386	246	303
Tractor-Implement	447	744	51	1,242	1,179	1,006
Industrial & Utility	1,792	493	42	2,327	2,067	1,150
Aircraft	18	110	21	149	146	97

NOTES:

[1] Since the figures on this report now reflect 100% of the U.S. Tire Market and previous RMA Monthly Tire Reports did not reflect 100% of the U.S. Tire Market, any comparisons of this report to previous ones should not be made.

[2] Figures have been adjusted to include those domestic and foreign manufacturers who do not report to RMA.

[3] In order to avoid possible double counting, export figures are as reported to RMA and as such will vary from data released in government reports.

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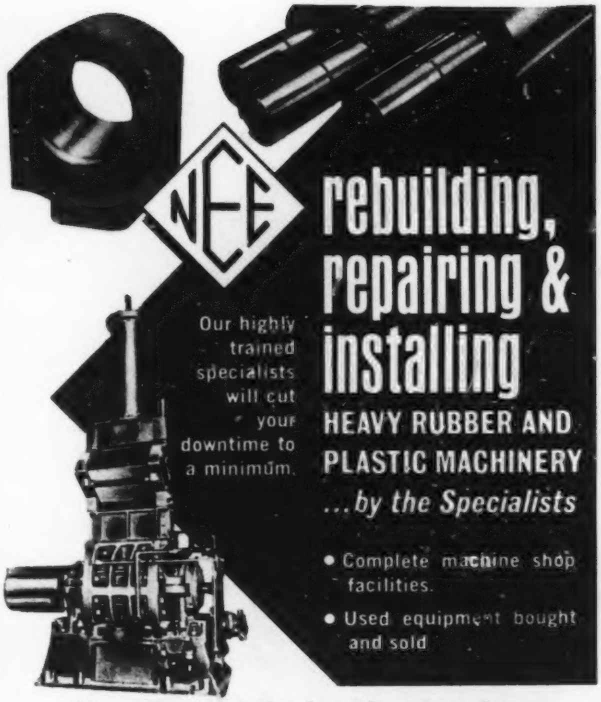
RMA Industry Rubber Report
(Figures are Expressed in Metric Tons)

	Feb. 1982	Cum. 1981	Cum. 1982
TOTAL NEW RUBBER			
New Rubber Available	270,116	604,677	645,023
Exports	34,753	69,409	75,846
Consumption	218,631	422,729	466,986
Stocks End of Month	479,504	—	—
NATURAL RUBBER			
Imports	88,033	118,579	134,958
Stock Pile Deliveries	—	—	—
Re-Exports	1,233	2,311	2,556
Consumption	52,344	101,106	120,224
Stocks End of Month	125,392	—	—
SYNTHETIC RUBBER			
Production	169,660	363,202	390,230
Imports	12,405	22,896	19,836
Exports	33,520	67,098	73,290
Consumption	166,287	328,624	346,764
% Total New Rubber	76.06	76.47	74.20
Stocks End of Month	354,112	—	—

Synthetic Rubber (Includes Latex)

	Feb. 1982	Cum. 1981	Cum. 1982
SBR			
Production	91,749	194,738	211,531
Imports	3,499	7,423	5,413
Exports	11,667	21,739	29,740
Consumption	91,152	176,832	193,424
Stocks End of Month	176,696	—	—
POLYBUTADIENE			
Production	26,348	57,127	60,976
Imports	3,163	5,621	5,291
Exports	3,640	7,539	5,792
Consumption	27,770	52,306	57,933
Stocks End of Month	47,087	—	—
NITRILE			
Production	5,141	10,275	12,236
Imports	1,085	1,961	1,722
Exports	378	902	2,618
Consumption	5,673	11,258	11,240
Stocks End of Month	17,115	—	—
ETHYLENE-PROPYLENE			
Production	[illegible]	27,330	34,864
Imports	1	1	8
Exports	2,477	5,277	5,343
Consumption	10,317	21,322	22,161
Stocks End of Month	33,884	—	—
POLYCHLOROPRENE			
Production	12,810	26,536	31,237
Imports	144	561	360
Exports	3,984	9,205	11,876
Consumption	8,100	16,513	18,257
Stocks End of Month	27,719	—	—
OTHER SYNTHETIC ELASTOMERS*			
Production	20,623	48,197	39,564
Imports	4,513	7,309	7,041
Exports	11,394	22,436	17,912
Consumption	22,275	40,393	43,749
Stocks End of Month	62,851	—	—
BUTYL			
Production	(D)	(D)	(D)
Imports	2,499	4,306	4,241
Exports	6,069	9,996	12,158
Consumption	12,601	23,697	23,291
Stocks End of Month	36,186	—	—
POLYISOPRENE			
Production	(D)	(D)	(D)
Imports	1,782	2,586	2,528
Exports	[illegible]	1,298	991
Consumption	5,262	9,153	11,856
Stocks End of Month	[illegible]	—	—

Source:
Production — As reported to RMA by participants
Imports — U.S. Department of Commerce, 1M 145X
Exports — U.S. Department of Commerce, EM 522
(Except Nitrile Latex which is as reported to RMA)
Consumption — Apparent consumption as calculated by RMA
Stocks End of Month — As reported to RMA and adjusted for 95-100% coverage.
Footnotes:
*Figures include Polyisoprene and Butyl rubber but exclude Polyurethane rubber.
D-Figures not released due to disclosure policy.



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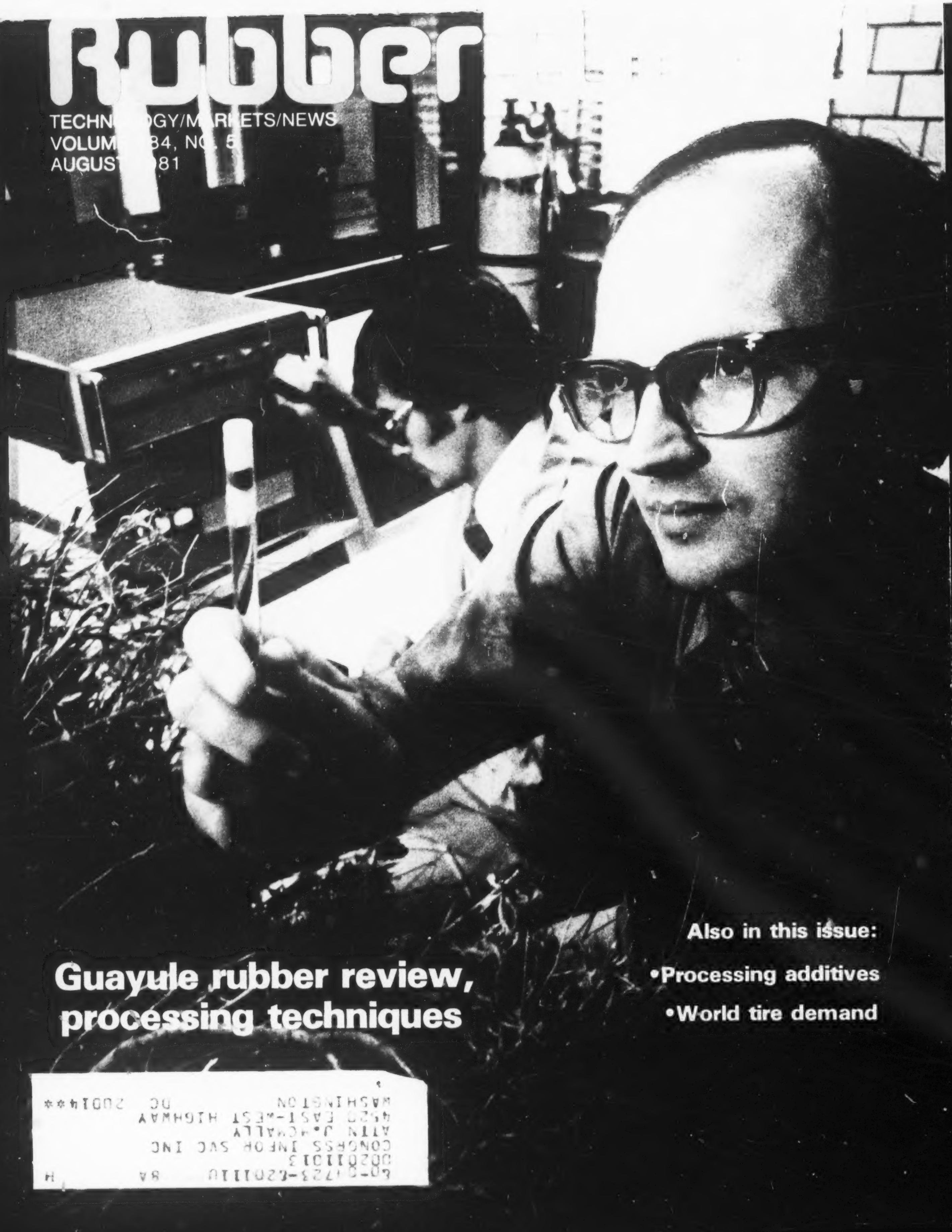
TECHNOLOGY/MARKETS/NEWS
VOLUME 84, NO. 5
AUGUST 981



Guayule rubber review, processing techniques

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- Processing additives
- World tire demand

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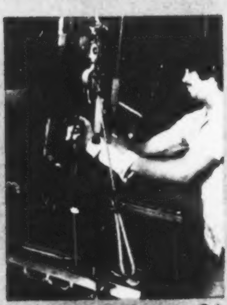
VOLUME 184/NUMBER 5/AUGUST 1981



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Cover

Analysis of molecules in a pill-sized sample of guayule shrub (dark area in glass tube) enables Goodyear researchers James Visintainer (foreground) and John Myers to estimate the amount of rubber in a single shrub or an entire desert crop. The Goodyear analytical process, developed by Visintainer, also will help create new strains of highly productive shrubs that could soon become the nation's first domestic source of natural rubber.

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Carbon black shipments decline

Total carbon black shipments in the U.S. fell 4% from the fourth quarter and were down 2% from the first quarter of 1980 with 346 thousand metric tons shipped. Domestic shipments of 327 mmt were off only 0.2% but 5% below the fourth quarter. Exports of 19 thousand tons decreased 25% from the previous first quarter but were up 34% over the last quarter of 1980. Compared to the first quarter of 1980, demand was stronger in all grades except the N-200, N-700 and N-900 series. Furnace production eased 0.7% from the fourth quarter, to 332 mmt, about 85% of capacity. Dry rubber consumption totaled 637 thousand metric tons, up 9% from the fourth quarter, but 4% below 1980's first quarter. The synthetic ratio of 77% was the highest in any quarter of the past four years and the carbon rubber ratio rose from 49.4% a year ago to 51.4 parts per hundred rubber.

Carbon Black Industry in the U.S.A.
(metric tons)

		1st Qtr. 1981	Percentage Change from 4th Qtr. '80	Percentage Change from 1st Qtr. '80
SAF	Prod	5,082	− 3.3%	+ 5.3%
(N-100)	Ship	5,179	− 2.7%	+ 2.7%
ISAF	Prod	35,692	+ 5.7%	−12.9%
(N-200)	Ship	36,601	− 0.6%	−13.5%
HAF	Prod	139,415	+ 1.5%	+ 1.8%
(N-300)	Ship	142,366	− 1.9%	+ 2.1%
FEF	Prod	36,131	+ 6.3%	+24.3%
(N-500)	Ship	36,480	+ 8.5%	+ 5.0%
GPF	Prod	83,003	+ 2.3%	+12.2%
(N-600)	Ship	82,962	− 1.0%	+ 5.9%
SRF	Prod	32,440	−23.9%	− 6.1%
(N-700)	Ship	33,595	−22.8%	−12.6%
Furnace	Prod	331,763	− 0.7%	+ 3.5%
	Ship	337,183	− 3.2%	− 0.3%
Thermal	Prod	12,191	− 7.0%	−11.1%
(N-900)	Ship	8,879	−21.3%	−39.7%
Total	Prod	343,954	− 0.9%	+ 2.9%
	Ship	346,062	− 3.8%	− 2.0%
Domestic Shipments (Included Above)		327,351	− 5.3%	− 0.2%
Domestic Share		94.6%		

Second quarter turnarounds posted by Goodyear, Uniroyal, BFG

Goodyear, Uniroyal and BFGoodrich announced significant increases in income during the second quarter of this year. The second quarter results are still impressive when compared to the recessionary figures of a year ago. Goodyear posted all-time sales records for the quarter and first six months. A 58.1% increase in second quarter earnings more than offset a first quarter decline bringing the first half net income of $111.3 million on sales of $4.6 billion. Second quarter sales were $2.3 billion, 14.5% above 1980's second

lion contrasted with $4 million in the second quarter of last year. Goodyear chairman Charles Pilliod said the company was able to operate its U.S. plants at higher, more efficient levels in the quarter as the replacement tire market strengthened, accompanied by a 25% increase in auto production and a 45% rise in truck production. Pilliod expressed optimism about U.S. markets for the remainder of the year and beyond. He said the massive retooling investment by the American auto industry is beginning to pay off and that the energy markets are creating a strong demand for industrial products such as conveyor belting.

Charles J. Pilliod, Jr.

BFG reported net income for the quarter at $24.9 million, up from $10 million a year ago. Six month figures show income of $51.3 million on sales of $1.6 billion compared to $30.3 million on sales of $1.5 billion in 1980. John Ong, chairman and chief executive, said even though he is pleased to report improved results he was more gratified by the implementation of strategic plans. "We have completed or announced divestments of non-strategic businesses of about one-fourth of the total divestment program. BFG is using the money from these divestments to fund a program for expanding high-return businesses. BFG's chemical group posted the largest gain for the quarter increasing income to $21.8 million from $4.6 the year before. The chemical group, however, is behind in the six month figures with income of $34.5 million compared to 1980's $38.9. The tire group income for the first six months is $42.2 million compared to $16.3 million in 1980 and the engineered products group had six month operating income of $5.4 million down from $13.2 million.

John Ong

Uniroyal posted its fourth straight quarter of profit improvement. The tire segment showed the biggest increase with an operating profit of $21 million compared to a $3 million loss in 1980. The chemical, rubber and plastics materials segment declined to $30 million from $36 million and engineered products reported an increase of $1 million to $6 million. Improvements in the tire segment were attributed to cost reductions and marketing improvements in the U.S. tire operations.

Rubber World Stock

		PRICE							TREND TO MARKET				EARNINGS/SHARE				
					Change		52 Week		Price Trend (% per day)		Volume Trend (% per day)			Latest 12 Months vs Preceding 12 Months Change		5 Year Annual Growth Rate	Profit Margin
Name	Symbol	High	Low	Close	Amt	Pct	High	Low	Last 30 Days	Last 5 Days	Last 30 Days	Last 5 Days	Last Fiscal Year	Amt	Pct		
		$	$	$	$	%	$	$	%	%	%	%	$	$	%	%	%
Tires and Inner Tubes																	
Aegis Corp	AO	3.63	2.75	2.88	-.13	-4.17	3.63	1.50	.19	-1.83	-1.95	23.96	.18	-.04 Q	-14.8	-5.0	1.3
Alliance Tire	ATRA	14.22	13.75	13.75	-.22	-1.57	14.22	6.59	.31	-.26	-.15	7.35	1.30	.87 Q	228.9	106.0	6.2
Armstrong Rub	ARM	37.50	35.00	36.00	.88	2.49	39.88	16.13	.06	.10	2.53	15.57	-10.17	-12.73 S	-256.1	-39.0	-4.1
Bandag Inc	BDG	27.25	23.50	24.50	-2.38	-8.84	27.63	17.88	-.02	.01	-5.71	-27.05	2.27	.24 Q	11.5	12.0	8.3
Cooper Tire	CTB	37.75	34.75	36.75	-.75	-2.00	42.00	10.63	.36	1.79	-.26	21.73	6.17	5.09 Q	226.2	12.0	4.0
Dunlop Holding	DLP	1.75	1.50	1.63	00	.00	1.94	1.31	.05	-.77	.86	70.37	-.67	-.71 F	-775.0	-30.0	-1.1
Firestone Tire	FIR	13.75	12.13	12.25	-.63	-4.85	13.75	6.63	-.02	-.05	-4.44	29.98	-2.11	.78 S	NE	-41.0	-2.5
Gen Tire	GY	29.50	26.63	27.25	-.88	-3.11	29.50	16.28	.08	-.72	-2.64	-10.93	1.65	1.93 S	162.1	-15.0	1.8
Goodrich B F	GR	26.25	24.38	24.50	-1.25	-4.85	28.13	19.63	.11	-.60	-3.72	11.01	3.57	-2.09 Q	-42.7	21.0	2.0
Goodyear Tire	GT	20.13	18.38	19.00	-.50	-2.56	20.25	14.75	.35	.10	.54	-.60	2.85	.96 Q	51.8	7.0	2.4
Mohawk Rub	MWK	16.00	13.75	14.00	-1.88	-11.81	23.75	7.84	-.94	.70	2.80	-3.07	2.57	2.36 Q	374.6	-3.0	2.6
Uniroyal Inc	R	10.38	8.88	8.88	-.38	-4.05	10.38	4.13	.00	-.44	-1.59	15.17	-.29	5.56 Q	NE	-93.0	-.3
Rubber Products																	
Amerace Corp	AAE	22.00	19.75	20.75	-1.00	-4.60	25.25	18.25	-.45	1.15	.96	-37.57	2.84	-.77 Q	-21.6	4.0	3.1
Am Biltrite	ABL	12.75	9.13	11.00	1.50	15.79	12.75	6.13	1.15	-1.63	9.99	-21.26	-4.78	-5.33 Q	-658.0	NE	-6.2
Carlisle Corp	CSL	49.25	36.50	39.00	-9.00	-18.75	54.75	18.00	-.57	-2.90	1.46	48.17	2.78	.80 Q	36.3	43.0	6.8
Dana Corp	DCN	32.75	26.75	27.25	-4.75	-14.84	33.50	20.13	-.49	-.36	-1.54	9.04	2.78	-2.88 Q	-57.9	-6.0	3.8
Dayco Corp	DAY	12.88	11.88	12.88	.38	3.00	14.38	11.00	.05	1.64	3.45	-2.95	1.10	-.96 S	-51.3	-11.0	1.2
Grt Amer Ind	GRI	16.00	14.25	14.63	-1.38	-8.59	18.88	10.13	-.27	.51	.95	-23.57	4.08	-.02 Q	-.5	24.0	5.7
OSullivan Cp	OSL	19.00	17.38	18.63	.63	3.47	19.00	9.38	.43	1.85	6.02	32.76	2.16	.44 Q	23.9	8.0	6.7
Pantasote Inc	PNT	5.88	5.00	5.88	.50	9.30	6.25	2.84	.93	1.79	6.85	-64.90	.30	.10 Q	28.5	-18.0	.8
Plymth Rub A	PLRA	7.38	7.00	7.00	-.25	-3.45	7.63	2.25	.93	-1.10	-3.65	-19.05	.02	.10 S	100.0	82.0	.2
Plymth Rub B	PLRB	6.50	6.00	6.00	-.38	-5.88	7.38	1.63	.80	-.05	-4.19	48.44	NA	NA	NA	NA	NA
Rubbermaid	RBD	37.00	32.50	33.50	-2.25	-6.29	39.50	22.75	-.37	.49	-1.83	-6.59	2.61	-.18 Q	-6.1	11.0	6.5
West Co	WST	28.75	26.50	27.00	-.75	-2.70	33.25	14.75	-.29	.27	.23	-7.76	2.55	.73 Q	35.4	16.0	6.7

(KEY: NA—Not Applicable NC—Not Calculable NE—Negative Earnings)
Q—First quarter S—Six months N—Nine months F—Fiscal year
**—Other than a quarterly multiple resulting from a fiscal year change*
Table prepared by Media General Financial Services, Richmond, Va. 23261

Financial statements

Bunawerke Huls reported 1980 sales of DM 525 million.

For its first 1981 quarter, **Celanese** reported a net income of $36 million, or $2.25 a share.

Crompton & Knowles reported 1980 net earnings of $8,823,000, or $3.87 per share from sales of $241,776,000. First quarter 1981 earnings of $1,821,000, or 53 cents a share, resulted from sales of $59,940,000.

Dayco has declared a regular quarterly dividend of $1.0625 on $4.25 convertible preferred stock, payable August 14 to shareholders of July 31 record.

Degussa's 1980 worldwide gross income was a reported DM 8.6 billion, 6 billion of which were accounted for by corporate sector metals, and 2.6 billion, by corporate sector chemicals. This was the first time foreign members of the Group achieved a gross income exceeding DM 1 billion.

Essex Chemical declared a 20-cents-per-share regular, quarterly cash dividend on its common stock. It is payable August 10 to holders of July 10 record.

Net income for **Firestone's** second quarter, ended April 30, came to $27 million, or 46 cents per share on sales of

Summary

P/E	DIVIDENDS			FINANCIAL POSITION					
							(Last Fiscal Year) Per Share		
P/E Ratio Today	Indicated Dvd Rate		Last X Dvd Date	(Last Fiscal Year) In $Millions		Current Ratio	Long Term Debt	Stock Equity	Last Bal Sheet Date
	Amt	Yield		Revenue	Earnings				
	$	%		$	$		$	$	
12.5	.00	.0	00-00-00	147.0	1.9	2.3	1.7	3	1280
11.0	.00	.0	06-26-81	62.8	3.9	1.2	6	5	1280
NE	1.40	3.9	06-01-81	401.3	-16.4	2.5	48.5	59	0980
10.6	.80	3.3	06-16-81	330.9	27.4	3.3	1.2	13	1280
5.0	.90	2.4	06-01-81	324.0	12.8	2.2	27.4	32	1280
NE	.08	4.9	05-26-81	3311.2	-35.8	1.6	4.6	6	1280
NE	.45	3.7	06-26-81	4850.5	-122.0	1.5	10.4	23	1080
8.7	1.50	5.5	07-30-81	2215.2	40.8	1.9	9.7	40	1180
8.8	1.56	6.4	06-01-81	3079.6	61.7	1.9	31.2	55	1280
6.8	1.30	6.8	05-11-81	8444.0	206.7	2.1	17.3	32	1280
4.7	.90	6.4	06-01-81	180.7	4.7	2.2	11.5	22	1280
22.8	.00	.0	08-22-78	2299.5	-7.8	2.0	19.8	16	1280
7.4	1.32	6.4	06-09-81	326.4	10.1	3.2	21.1	45	1280
NE	.30	2.7	06-16-81	207.6	3.3	2.3	10.8	21	1279
13.0	.72	1.8	05-15-81	380.8	25.8	2.3	4.6	11	1280
13.0	1.60	5.9	08-21-81	2524.0	95.7	2.1	9.7	28	0880
14.1	.56	4.3	06-30-81	716.4	8.6	2.2	29.9	26	1080
3.7	.00	.0	00-00-00	115.3	6.6	2.2	9.2	19	1280
8.2	.60	3.2	06-09-81	60.8	4.1	3.3	.0	11	1280
13.1	.00	.0	12-24-80	148.7	1.2	1.6	3.9	8	1280
35.0	.00	.0	00-00-00	63.8	.1	1.5	.0	7	1180
NA	.00	.0	00-00-00	NA	NA	NA	NA	NA	NA
12.1	1.08	3.2	08-10-81	308.9	20.1	1.9	2.0	18	1280
9.7	.60	2.2	07-08-81	148.2	9.9	2.1	3.3	17	1280

All information in this table is based on sources believed to be reliable, but its accuracy is not guaranteed. Every effort will be made to correct errors, when discovered in future editions.

$1.1 billion. This compares to last year's first quarter loss of $52 million, or 90 cents per share on sales of $1.2 billion. The company also reported net income of $103 million, or $1.78 per share on sales of $2.2 billion, for its first six months. This compares to 1980's first half loss of $66 million, or $1.14 per share on sales of $2.4 billion.

Reported sales of $48.2 million from **Foote Mineral's** first 1981 quarter produced net earnings of $2,356,000, or 29 cents per common share.

Foxboro reported a 1980 net income of $32 million, or $3.87 per share. This, on sales of $509 million.

reported net sales of $658,199,000 that produced net income of $22,667,000, or 93 cents per share. Reported six-month sales totaled $1,226,733,000, while net income came to $24,793,000, or $1.02 per share. These figures included a first quarter charge for a charitable contribution to a non-profit organization. First half net income was thus reduced 18 cents per share.

The company also announced a 37½-cents per share cash dividend on the company's issued and outstanding 30 cents par value stock. It is payable August 31 to holders of August 5 record.

W.R. Grace's first quarter 1981 sales amounted to $1.48 billion and produced earnings of $83 million, or $1.75 per share.

American Hoechst reported that its 1980 sales of $1.29 billion produced a $10 million loss. This, from 13 operating units.

Huls Group reported 1980 sales of DM 5.7 billion, a 3.4% increase over 1979's DM 5.4 billion. The 1980 sales for the parent company amounted to 5.3 million tonnes, a decrease of 1.2% from 1979's 5.4 million.

For the quarter ended March 31, **Owens-Corning Fiberglas** announced net earnings of $12.5 million, or 41 cents per share from sales totaling $539.5 million. These figures compare to first quarter 1980's net earnings of $18.9 million, or 62 cents per share on sales of $579.3 million.

Pennwalt reported a first quarter 1981 net income of $1.89 a share, up from the year-earlier amount of $1.20 a share. The 1981 figure comes from reported 74-cents-a-share net earnings from continuing operations, a loss of 49 cents per share from discontinued operations and a special gain of $1.64 a share from an accounting charge.

For its first fiscal 1981 quarter, ended December 31, **Petrolane** reported revenue of $460,452,000, and a net income of $27,009,000, or $1.04 per share. Petrolane's second quarter, ended March 31, brought in revenue totaling $509,953,000 that produced net income of $27,528,000, or 53 cents per share.

Pfizer's worldwide sales for the first quarter were reported to be $818.2 million. The company also reported net income amounting to $72.1 million, or 96 cents a share.

St. Joe Minerals' first quarter revenue of $229.3 million produced earnings of $256.2 million, or $5.65 a share. This is a 13% drop from last year's first quarter, and due to the sale and takeover costs of Canadian oil and gas interests. These actions led to a proposed merger with Fluor Corp.

Reported first quarter earnings for **Stauffer Chemical** came to $87.9 million, or $2 per share.

Sun Chemical reported 1980 sales of $514 million that produced $31.4 million in net income. This came to $4.52 per share earnings.

U.S.& World Rubber News

Rubber industry outlook brighter for next year

U.S.A. rubber consumption indicators

Monthly averages of	1979 Total	1980 July to Sept	1980 Oct to Dec	1980 Total	1981 Jan	1981 Feb	1981 March
Index of Leading Indicators	140.2 (−1.1%)	131.2 (−6.6%)	137.7 (+1.1%)	131.6 (−6.0%)	135.0 (+0.1%)	134.3 (+3.7%)	136.2
Index of Industrial Production	152.5 (+4.4%)	142.9 (−6.6%)	148.6 (−2.3%)	147.1 (−3.6%)	147.0 (−0.5%)	151.0 (−1.0%)	152.7 (−0.3%)
Index of Tyre Production	159.1 (−3.6%)	105.8 (−26.4%)	137.4 (−6.5%)	124.9 (−21.4%)	125.7 (−10.5%)	134.9 (−11.1%)	139.0 (−6.3%)
Index of Other Rubber Goods Production	153.8 (−2.2%)	130.7 (−13.7%)	143.1 (−4.9%)	139.1 (−9.6%)	139.1 (−2.1%)	146.7 (−0.9%)	146.2 (+1.0%)
Index of Car Production	136.7 (−7.9%)	80.4 (−29.7%)	111.6 (−6.9%)	103.6 (−24.2%)	90.0 (−7.7%)	102.9 (−17.7%)	121.3 (−5.5%)
Index of Bus & Truck Production	212.5 (−14.2%)	90.6 (−41.5%)	131.2 (−17.3%)	117.5 (−44.7%)	124.5 (−5.4%)	126.5 (−23.1%)	143.6 (+3.8)
Motor Gas Consumption (mn tonnes)	7.03 (−5.2%)	6.77 (−3.6%)	6.80 (−0.5%)	6.68 (−5.0%)	6.06 (−6.7%)	6.17 (−6.5%)	5.99 (−6.5%)

Notes: 1. Figures in brackets measure the percentage change on the same period of the previous year.
2. All index numbers have the base year 1967 = 100.

LONDON — The short term prospects are gloomy in the rubber industry but 1982 appears to be promising according to a recent study by the Economic Intelligence Unit.

The study shows, as expected, the total rubber demand has been hard hit during 1980 and the beginning of 1981 with conditions still uncertain in the tire and general rubber sectors.

The EIU said there are signs of a revival slowly emerging, particularly in the U.S. However, the latest forecasts of rubber demand show that consumption during 1981 will be only marginally up compared with 1980, perhaps by no more than 2%.

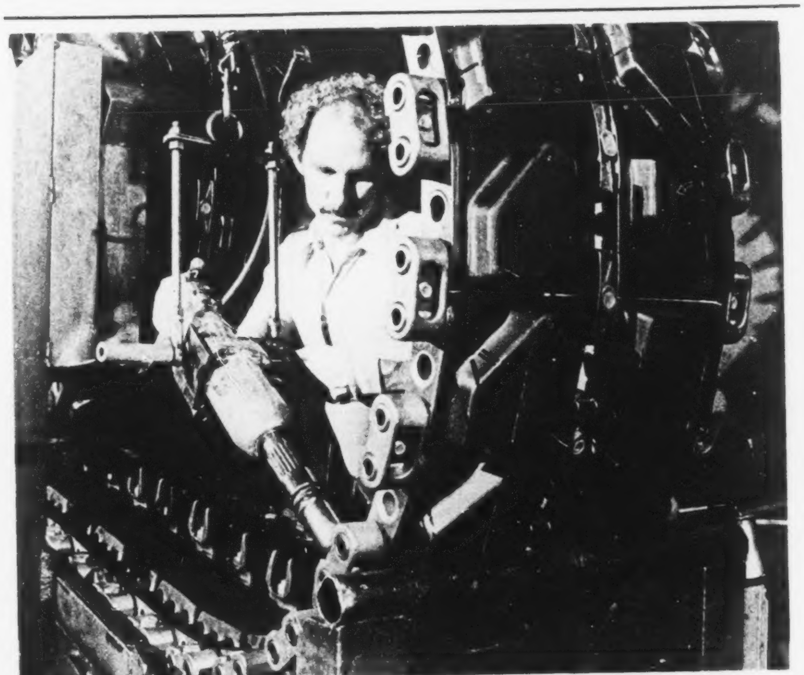
Other conclusions from the report:

- On the basis of current forecasts, it is believed that 1982 could see a marked upswing in demand for tires, and preliminary estimates indicate an increase in total rubber consumption of about 4% next year.
- The price of natural rubber is likely to remain subdued and may even fall back in the short term as a result of quiet conditions, especially during the summer months.
- There is continued pressure on synthetic rubber manufacturers to put up their prices, though this will be done gradually and very cautiously in the face of the current recession.
- It is believed that the price of natural rubber will fluctuate at around the recent level of 55 pence per kilo, but, on fundamental grounds, it is believed that RSS1 is undervalued by 15 to 20% when measured against the price of synthetics. Any increase in the price of RSS1, however, may not take place for some time, at least until rubber consumption shows definite signs of a marked recovery.

Landell Mill Commodities Studies report in their latest rubber bulletin that the speculative purchases of rubber which pushed up prices at the end of June also coincided with an upturn in physical demand in the U.S. and Japan.

The substantial pick up in auto production in the US in the second quarter pushed up demand for rubber. In Japan, the pick up in rubber demand followed several months of unusually low purchases resulting from a general shake-out of stocks which is now complete.

On the synthetic side, LMC noted that the current glut of crude oil is not yet helping producers of synthetic rubber, since the market for butadiene remains fairly tight. Suppliers of butadiene are considering third quarter price increases in Europe, since recent exchange rate changes have widened the gap between the U.S. and European prices for butadiene.



THE FINAL section of track for the Army's new M1 tank is fastened together at Goodyear's St. Marys, OH, plant. The 59-ton tank's two huge tracks feature a special synthetic rubber compound developed by Goodyear to take severe pounding.

Pressure sensitive adhesives growth seen

NEW YORK, N.Y. — The pressure sensitive adhesive market is projected to expand at a 6% rate during the decade a report by Frost & Sullivan indicates. This will be highlighted by a 10% growth in hot melt adhesives and 8-10% advances in labels.

Annual volume of PSA is currently estimated at 370 million pounds, equivalent to $295 million, the marketing research firm says. Sales of pressure sensitive products in the U.S. are loosely estimated at nearly $2 billion, with tapes accounting for some $1.1 billion and labels amounting to about $640 million.

Paper tapes are the largest factor in the pressure-sensitive tape market, with an estimated 520 million square yards of saturated paper used for tapes and 100 million square yards for protective sheets. Film tapes follow, with annual consumption put at some 114 million pounds.

"The main growth of pressure sensitive tapes is expected not because of new materials or new constructions, but from the combination of pressure sensitive adhesives with existing products," the report states. "Pressure sensitive adhesives offer an easy way for fast bonding applications."

In the label market, sale of industrial labells are projected to increase steadily from $400 million in 1980 to $721 million by 1987, while electronic data processing labels advance from $120 million to $215 million and office and retail labels climb from $120 million to $206 million.

Elastomers are the primary ingredient in pressure sensitive adhesives, amounting to a 210 million pound market growing about 8% annually, the 286-page study says. Natural rubber is the most commonly used elastomer, accounting for 30% of the market, followed by polyacrylates (26%), styrene-butadiene rubber (20%), block copolymers (15%), butyl rubber (5%) and others (4%).

Tackifying resin is the second most important ingredient, with consumption in pressure sensitive adhesives estimated at 113 million pounds. Hydrocarbon (C-5) based resins account for 39% of this market, followed by polyterpenes and derivatives (29%), rosins and derivatives (28%) and others (4%).

Other ingredients used in adhesives include plasticizers (34 million pounds) and fillers (26 million pounds), with minor applications of release coatings, prime coatings, antioxidants, heat stabilizers, flame retardants and biocides.

Some pressure sensitive adhesives are still applied from solvent solutions, the report adds. While a sharp decrease in solvent usage has been predicted by many sources, "such predictions do not always take into account that many large adhesive product manufacturers are equipped to recover the solvent, and, therefore, have no compelling economic reasons to make the change," Frost & Sullivan points out. Annual consumption of solvents for pressure sensitive adhesives is estimated at 640 million pounds. Solvents getting the most use in this area are toulene and heptane for rubber, and esters, ketones and alcohols for acrylic adhesives.

RMA industry rubber report
(figures are expressed in metric tons)

	Apr. 1981	Mar. 1981	Cum. 1981	Cum. 1980
Total new rubber				
New Rubber Available	261,304	266,092	1,032,073	1,080,322R
Exports	35,001	41,868	146,278	169,826
Consumption	202,718	250,889	883,336	909,482R
Stocks End of Month	488,871	467,803	—	—
Natural rubber				
Imports	68,704	54,241	241,524	249,630
Stock Pile Deliveries	508	—	508	—
Re-Exports	1,626	1,432	5,369	7,607
Consumption	54,718	55,210	211,033	222,770
Stocks End of Month	125,310	122,761	—	—
Synthetic rubber				
Production	180,940	200,050	744,192	789,398
Imports	11,152	11,801	45,849	41,294R
Exports	33,375	40,436	140,909	162,219
Consumption	148,000	195,679	672,303	686,712R
% Total New Rubber	73.01	77.99	78.11	75.51
Stocks End of Month	363,561	345,042	—	—

RMA monthly tire report
(figures in thousands of units)

	May 1981[1]					
	Shipments					
	Original Equipment	Replacement	Export	Total	Production	Mfgs. Inventory
Pneumatic Tires						
Passenger	3,746	11,499	318	15,563	12,513	32,282
Radial	3,109	6,891	219	10,219	8,896	19,833
Truck & Bus	546	2,352	158	3,056	2,670	8,333
Radial	107	709	23	839	530	2,209
Mobile Home	139	7	—	146	158	125
Motorcycle	16	131	10	157	88	326
Tractor-Implement	140	176	15	331	353	981
Industrial & Utility	499	165	11	675	673	1,122
Aircraft	6	29	7	42	47	97

THE CAMERA-LIKE device is an optical pyrometer that gauges the temperature of molton glass streaming from a furnace at PPG Industries' Lake Charles, La., silicas plant.

World tire demand to exceed 1.1 billion units by 1995

by David L. Schultz, Editor

World tire consumption has been increasing at an annual rate of 3.9%, and exceeded 675 million units in 1979, according to Predicast, a Cleveland-based research firm. In its latest report on world rubber and tire markets, the company attributes this growth to moderate gains in motor vehicle demand.

As a result of gains in the motor vehicle stock, the report says, replacement tire requirements increased 3.7% per year. Increased vehicle production and consumption in the developing nations generated a higher level of original equipment requirements. Tire output increased sharply outside of North America, particularly in countries with strong domestic demand, the report states. But with this came a shift in the world trade profile. Japan and the European Community became significant net exporters while the U.S. became a major net importer.

The decelerating growth rate of motor vehicle demand, the report says, will slow gains in tire requirements in the developed countries. However, world tire demand will exceed 1.1 billion units by 1995. Increased penetration of longer-life radial tires, other technological improvements and reduced mileage on tires because of increasing motor vehicle operation costs will adversely affect the demand for replacement tires.

Tire output is expected to slow especially in North America, Western Europe and Japan. This will be partially offset by increases in Eastern Europe and the developing countries. Changes in the world trade structure will again take place, the report goes on, with Africa and the Mideast becoming the largest net importing region by 1995.

World rubber consumption has been increasing at a more dramatic rate than tire output (5.2% annually) due to large gains in the non-tire rubber sector, especially in Eastern Europe and the rapidly-developing nations. North America and Western Europe accounted for 59% of world rubber requirements in the period 1966-1968, but this share declined to 48% in 1979.

World rubber production in 1979 was 13.1 million metric tons, with synthetic rubber accounting for 70% — up from 64% in 1966-1968. Commercial success of synthetic rubber was aided by declining petrochemical feedstock prices, economies of scale, stable supply, technological improvements and the development of new types of specialty synthetics (see *RW*, Vol. 184, No. 3, June 1981, p. 36). During the same period, natural rubber growth was slowed by fluctuating prices and unstable supplies. However, natural rubber has been improving its position due to petroleum-induced price increases for synthetic rubber.

Rubber consumption through 1995 is expected to grow more slowly, at an annual percentage rate of 4%. This figure reflects the slowdown in tire rubber demand brought about by a lower rate of replacement and a smaller amount of rubber consumed per tire. Non-tire rubber, too, is expected to slow, mainly in the developed countries.

Natural rubber production will grow at a faster rate than synthetic and reverse the historical trend. Increased synthetic costs will serve to make natural rubber prices more

World Tire Supply-Demand
(mil units)

Item	66/8	1979	1995	% Annual Growth Historic	% Annual Growth Projected
Total Consumption	427.6	677.3	1117.2	3.9	3.2
OEM	142.9	236.5	408.3	4.3	3.5
Replacement	284.8	440.8	708.9	3.7	3.0
Total Production	423.2	674.6	1117.2	4.0	3.2
United States	181.8	212.3	290.0	1.3	2.0
Canada	15.5	23.5	39.0	3.5	3.2
Brazil	5.6	20.3	45.0	11.3	5.1
Mexico	2.6	7.5	21.0	9.2	6.6
Other Latin America	6.0	13.3	29.3	6.9	5.1
European Community	105.5	154.1	234.0	3.2	2.6
Spain	4.8	15.3	28.0	10.1	3.8
Other Western Europe Non-EC	9.1	14.0	25.8	3.7	3.9
USSR	20.6	41.2	73.0	5.9	3.6
Other Eastern Europe	10.9	28.5	65.1	8.3	5.3
Africa-Mideast	5.9	12.4	31.4	6.4	6.0
Japan	42.8	101.0	172.0	7.4	3.4
China	.7	2.4	5.8	10.8	5.7
Other Asia	4.7	20.5	46.5	13.1	5.3
Oceania	6.6	8.2	11.3	1.8	2.0

Note: Production and consumption totals may not agree due to changes in stocks and statistical discrepancies.

Tire Rubber Consumption
(000 metric tons)

Country	66/8	69/71	72/5	76/8	1979	1985	1990	1995
World	3485	4351	5112	5599	5949	7315	8505	9640
North America	1585	1860	2066	2124	2130	2390	2630	2860
United States	1471	1717	1908	1923	1907	2120	2320	2500
Canada	114	142	158	201	223	270	310	360
Latin America	155	194	273	362	401	580	725	860
Argentina	26	36	44	45	48	75	90	110
Brazil	63	79	124	173	191	270	335	390
Mexico	27	33	46	68	73	120	160	195
Colombia	10	10	12	21	29	40	50	60
Venezuela	14	18	25	31	34	45	55	65
Other	15	18	23	23	26	30	35	40
European Community	774	983	1018	1044	1055	1227	1397	1552
France	186	256	295	310	338	377	418	454
Italy	129	157	173	173	183	230	285	330
West Germany	204	279	274	284	287	330	365	400
United Kingdom	208	235	219	220	187	220	250	280
Netherlands	17	20	23	19	19	25	30	35
Belgium-Luxembourg	31	36	34	39	42	45	49	53
Other	—	—	—	—	—	—	—	—
Western Europe Non-Ec	109	165	213	197	232	290	347	400
Sweden	29	36	27	22	24	33	40	48
Spain	44	77	118	108	132	165	195	220
Austria	24	34	47	46	51	60	70	80
Other	11	19	22	21	25	32	42	52
Eastern Europe	413	471	610	769	827	1140	1365	1575
USSR	299	321	411	521	551	740	860	960
Czechoslovakia	17	23	35	41	48	55	75	95
East Germany	39	44	53	62	68	95	115	135
Poland	21	30	41	50	60	80	95	115
Romania	16	22	29	36	40	70	95	120
Yugoslavia	8	16	21	34	41	60	75	90
Hungary	10	9	10	11	11	20	25	30
Bulgaria	3	5	10	13	12	20	25	30
Africa-Mideast	60	91	132	139	145	201	266	350
South Africa	22	30	37	31	34	40	50	60
Iran	6	13	17	21	20	25	35	43
Israel	10	17	20	18	14	21	26	32
Other	23	31	59	69	78	115	155	215
Asia	330	510	713	884	1089	1410	1690	1950
Japan	252	392	532	619	750	940	1100	1250
China	12	20	28	36	41	50	70	90
India	30	40	48	52	58	75	95	115
Other	37	58	105	177	284	345	425	495
Oceania	59	79	87	80	70	77	85	93
Australia	50	66	73	66	56	60	63	66
New Zealand	10	13	14	14	14	17	22	27
Other	—	—	—	—	—	—	—	—

competitive. This, combined with technological innovations (e.g. advanced planting and harvesting techniques, the introduction of guayule and other heartier strains of natural rubber) and marketing improvements within the industry itself will improve natural rubber's world position. The net result is expected to be an accelerated 4.7% annual growth in natural rubber, with output approaching 8 million metric tons by 1995, and a deceleration of growth in synthetic rubber output.

World tire supply/demand

A number of technical and economic factors have contributed to slow the growth in world tire demand to 3.2% annually through 1995. Total demand is nonetheless expected to exceed 1.1 billion units by 1995; and production will increase accordingly. Because of inventory adjustment, supply (production) and demand will not necessarily be equal in any given year. Over the span of several years, however, supply and demand are expected to balance.

OE tire requirements are directly related to vehicle production. The report states that combined world production of passenger cars and commercial vehicles increased 4.3% annually from the mid-1960s to 1979, when it approached 44 million units. Growth is expected to decline to 3.5% per annum; and world motor vehicle production is projected at 75 million units in 1995.

World rubber consumption

The world demand for rubber in-

Total Tire Requirements
(mil units)

Country	66/8	69/71	72/5	76/8	1979	1985	1990	1995
World	427.6	523.6	596.0	658.6	677.3	829.8	973.8	1117.2
North America	199.1	231.1	243.9	259.6	251.3	282.4	312.6	341.6
United States	183.0	211.1	220.4	235.5	227.2	252.6	277.4	300.2
Canada	16.0	20.0	23.4	24.1	24.1	29.8	35.2	41.4
Latin America	17.5	22.7	33.0	40.8	45.1	65.4	84.4	104.7
Argentina	3.3	4.2	5.3	5.8	6.3	9.2	11.9	14.4
Brazil	4.7	7.0	12.4	16.5	18.1	26.4	33.4	41.5
Mexico	3.2	4.3	6.2	7.4	8.5	13.6	18.5	23.1
Colombia	.5	.8	.9	1.2	1.4	2.1	2.9	3.9
Venezuela	1.5	1.9	2.7	3.7	4.5	5.9	7.8	9.9
Other	4.4	4.5	5.5	6.2	6.2	8.2	9.9	11.9
European Community	102.0	123.3	129.4	136.7	141.5	160.1	183.4	203.6
France	23.0	28.9	33.5	36.7	38.6	44.5	50.9	55.6
Italy	17.5	21.7	23.4	23.9	24.5	28.5	33.3	36.4
West Germany	28.3	35.3	34.7	37.9	39.2	42.5	47.2	51.9
United Kingdom	25.4	27.3	26.6	24.8	25.0	27.2	31.1	35.1
Netherlands	2.6	3.4	3.9	4.5	4.9	6.0	7.3	8.3
Belgium-Luxembourg	2.5	3.4	3.5	4.3	4.4	5.1	6.0	7.3
Other	2.7	3.2	3.8	4.5	5.0	6.3	7.6	9.0
Western Europe Non-Ec	17.5	22.6	28.1	31.2	32.4	41.7	50.9	61.0
Sweden	4.6	5.8	6.2	6.4	6.6	7.4	8.3	9.3
Spain	5.0	6.8	10.4	12.3	13.1	17.2	22.3	27.6
Austria	3.1	3.5	4.0	4.3	4.5	6.6	7.8	9.0
Other	4.8	6.4	7.5	8.2	8.3	10.5	12.5	15.1
Eastern Europe	31.5	37.9	49.7	58.3	63.6	89.7	110.6	130.7
USSR	20.9	23.4	29.6	32.9	35.4	49.2	57.6	64.1
Czechoslovakia	1.9	2.4	3.3	4.1	4.5	5.5	7.2	8.9
East Germany	4.6	5.6	6.9	7.8	8.6	11.5	14.7	17.7
Poland	1.7	2.2	3.5	5.0	5.7	8.0	9.7	12.0
Romania	.4	.5	.9	1.2	1.3	3.0	4.7	6.5
Yugoslavia	1.2	2.3	3.6	4.9	5.4	8.2	10.8	14.0
Hungary	.6	.9	1.3	1.8	1.9	3.2	4.3	5.4
Bulgaria	.3	.5	.6	.6	.8	1.1	1.6	2.1
Africa-Mideast	10.8	13.7	18.3	22.5	23.7	33.1	44.4	58.4
South Africa	2.8	3.7	4.5	5.2	5.8	7.4	9.3	11.6
Iran	.7	1.1	2.0	3.6	3.7	4.0	6.0	7.9
Israel	.3	.5	.7	.9	1.0	1.4	1.9	2.4
Other	6.9	8.4	11.2	12.9	13.3	20.3	27.2	36.5
Asia	40.7	62.5	82.3	97.4	107.1	141.9	169.7	197.1
Japan	33.2	52.3	68.5	79.9	87.2	111.7	128.3	144.5
China	1.2	1.5	2.2	2.5	2.8	5.2	8.3	11.5
India	1.8	2.3	2.7	2.9	3.2	4.4	5.7	6.9
Other	4.5	6.4	8.8	12.1	14.0	20.6	27.4	34.2
Oceania	8.5	9.9	11.2	12.1	12.6	15.5	17.8	20.1
Australia	7.0	8.1	9.1	9.8	10.2	12.5	14.3	16.0
New Zealand	1.3	1.6	1.8	1.9	2.0	2.3	2.7	3.1
Other	.2	.3	.4	.5	.5	.7	.8	1.0

creased 5.2% per year between 1966/1968 and 1979 and exceeded 13 million metric tons. Demand from the tire industry increased at a slower rate keeping pace with the motor vehicle industry as requirements of the non-tire rubber products increased 5.8% per annum.

World rubber demand is expected to increase 4% annually through 1995. Slower economic growth, maturing of the rubber-consuming markets and realignment of the tire industry will limit increases in rubber demand in the U.S. and other developed countries to below the expected world rate of growth. At the same time, the gradual shift of the tire and rubber industries away from the developed nations will result in strong increases in rubber consumption in Latin America, Eastern Europe, Africa-Mideast and Asia.

The world tire industry requires nearly half of all rubber consumed. This proportion is higher in the developed countries where a high level of tire production is spurred by greater motor vehicle use. Tire rubber consumption increased from 3.5 to 6.0 million metric tons between 1966/1968 and 1979.

Tire rubber consumption increased slightly faster than motor vehicle tire production due to three major factors. First, the shift away from commercial vehicles toward passenger cars was reversed in the 1970s, particularly in the developed nations. The popularity of radial tires, which weigh more than bias-ply or glass-belted tires, has grown. And finally, rapid industrialization in the developing countries has warranted a greater need for commercial vehicles. As a result, the average of rubber consumed per tire increased nearly 8% during the historical period.

Because of the anticipated slowdown in growth of both the vehicle and tire industries, tire rubber demand will ease through 1995. Increases in consumption will slow to an annual rate of 3.0% as compared to the historical rate of 4.6%.

However, tire production will increase by 3.2% per year. The major reasons for this growth will be substantial reductions in tire sizes to accommodate the increasing demand for smaller fuel-efficient motor vehicles as well as a shift of the tire industry toward the developing nations where passenger car demand will increase rapidly as economic environments advance.

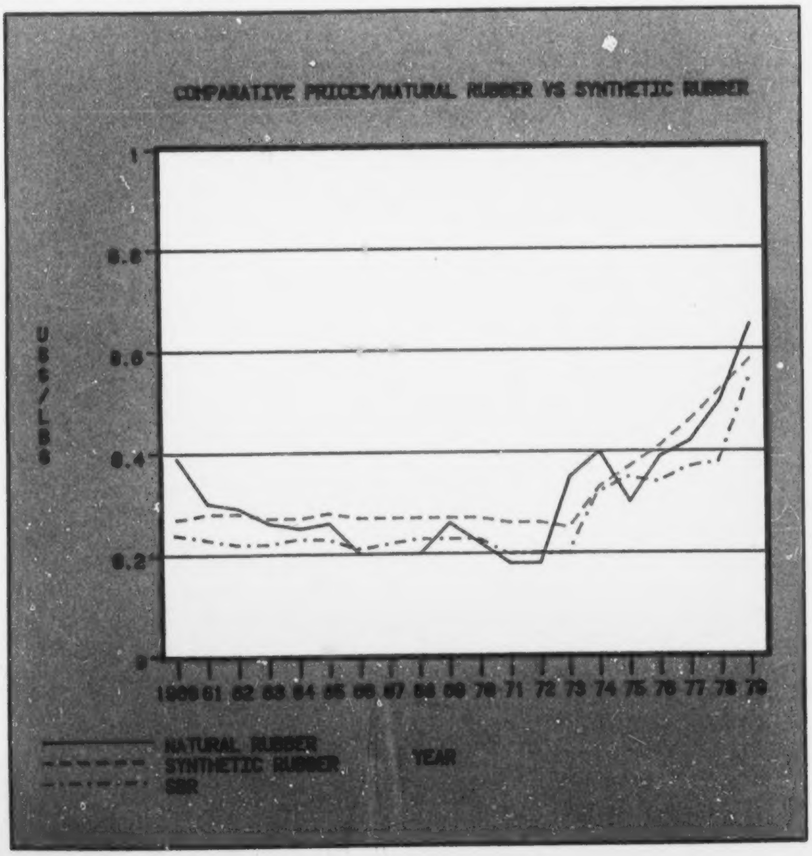
Several changes in the regional distribution of tire rubber requirements during the past decade are evident. North America's share of the world total has dropped from 42% to less than 32%, with the EC exhibiting a similar decline. The greatest increase in share of total tire rubber demand was recorded by Asia (Japan) and Latin America (Brazil), where consumption increased 230% and 160% respectively, despite a decline in rubber used per tire.

World rubber production

The Predicast report states that world rubber production increased at a 5.2% annual rate since the mid-1960s. Synthetic rubber output grew at a much faster rate than natural rubber, increasing its market share to more than 70%. This shift away from natural rubber was paralleled by a similar shift away from the other general-purpose rubbers.

Whereas in 1966/1968 ethylene-propylene, butyl, chloroprene, nitrile and the other specialty rubbers had a combined share of 16% of the synthetic rubber market, by 1979 their combined output of 2.3 million metric tons represented a nearly 25% share. However, several factors that enabled the rapid growth in rubber production, synthetic rubber in particular, have changed since the early 1970s.

Lower rubber demand (primarily from the tire market), higher synthetic prices due to increased costs of raw materials and processing, and greater use of rubber substitutes, especially plastics, will serve to slow future growth in total production and allow natural rubber to gain back a portion of its currently lost share of output.



Rapidly-increasing petrochemical feedstock prices have improved the outlook for natural rubber. Equally important are the changes taking place within the industry itself. Historically, one of the major drawbacks to natural rubber has been its erratic prices. This is due to the shortrun price inelasticity of natural rubber supply and demand.

Attempting to offset much of this fluctuation, a draft International Natural Rubber Agreement on price stabilization was concluded in October, 1979. The agreement was ratified by the various nations and was either accepted fully or accepted on a provisional basis, as in the case of the U.S. Prices initially set at approximately 45 cents per pound with a 15-20% band, are supposed to be a controlling factor in the buildup of an international natural rubber stockpile or buffer stock.

An appointed buffer stock manager has the option of buying rubber for the stockpile if the price falls between 15 and 20%, and must buy if the price falls further than 20%. Likewise, he has the option to sell if the market price increases to between 15 and 20%, and must sell above 20%. This agreement has set the mood for expansion of the natural rubber industry, but it will not be effective for some years to come due to adjustments which must be made to provide internationally-balanced stockpiles.

As an example, U.S. RSS-1 grade rubber was 80 cents per pound in October, 1980. In this case, the price was 76% above the proposed initial price, and the buffer stock manager was required to sell natural rubber from a stockpile that did not yet exist.

Natural rubber production has been increasing at a 3.3% annual rate and is projected to grow 4.7% per year through 1995. Although its share of the total elastomer market will not recover to the 1960s level (33% in 1995 as opposed to 36.4% in 1966/1968), natural rubber will increase its penetration into the general-purpose rubber market with its share of the total reaching 41% by 1995.

Synthetic rubber

Since the early 1950s — when production of synthetic rubbers began on a large scale — synthetic rubber's competitive position and market share have greatly increased relative to natural rubber's position in the

(continued on page 56)

(Continued from page 24)

Synthetic Rubber Production
(000 metric tons)

Country	**66/8**	**69/71**	**72/5**	**76/8**	**1979**	**1985**	**1990**	**1995**
World	4506	5882	7246	8455	9249	11630	13900	16340
North America	2237	2465	2564	2749	2911	3125	3415	3650
United States	2037	2265	2362	2517	2628	2805	3065	3270
Canada	200	200	202	232	283	320	350	380
Latin America	91	159	237	302	359	560	750	945
Argentina	17	40	49	38	37	50	70	90
Brazil	55	72	126	186	224	330	420	515
Mexico	18	45	58	71	90	150	200	250
Colombia	—	—	neg	1	2	2	4	6
Venezuela	neg	1	2	3	4	14	26	38
Other	1	2	2	3	3	14	30	46
European Community	892	1299	1581	1784	1859	2235	2550	2900
France	192	305	410	469	541	585	645	710
Italy	122	150	214	247	270	375	445	535
West Germany	208	300	345	398	418	525	595	660
United Kingdom	216	294	320	314	278	325	370	415
Netherlands	133	202	228	237	227	275	315	370
Belgium-Luxembourg	22	48	64	119	125	150	180	210
Other	—	—	—	—	—	—	—	—
Western Europe Non-Ec	13	40	65	98	103	175	265	350
Sweden	—	—	2	11	10	25	40	50
Spain	13	40	63	78	80	125	175	230
Austria	—	—	—	2	4	5	10	10
Other	—	—	—	7	9	20	40	60
Eastern Europe	876	1123	1790	2292	2556	3490	4255	4965
USSR	653	828	1400	1817	2025	2575	2990	3360
Czechoslovakia	33	48	54	58	57	80	105	130
East Germany	104	120	137	146	165	205	245	295
Poland	40	59	95	121	130	190	250	330
Romania	47	62	87	126	149	280	390	510
Yugoslavia	—	—	—	—	—	70	120	175
Hungary	—	—	—	—	—	25	45	65
Bulgaria	—	5	17	24	30	65	80	100
Africa-Mideast	23	27	33	50	54	140	245	385
South Africa	23	27	31	31	31	70	115	190
Iran	—	—	—	—	—	25	65	110
Israel	—	—	—	—	—	—	—	—
Other	—	—	2	19	23	45	65	85
Asia	348	732	933	1157	1364	1855	2465	3085
Japan	298	668	858	980	1107	1410	1645	1845
China	28	35	39	60	80	180	240	320
India	21	29	22	26	32	50	65	80
Other	—	—	13	70	145	215	515	840
Oceania	26	37	42	43	43	50	55	60
Australia	26	37	42	43	43	50	55	60
New Zealand	—	—	—	—	—	—	—	—
Other	—	—	—	—	—	—	—	—

World Rubber — Supply Demand
(000 metric tons)

Item	66/8	1979	1995	% Annual Growth Historic	% Annual Growth Projected
Rubber Consumption	7053	13010	24335	5.2	4.0
Natural	2628	3891	7995	3.3	4.6
Synthetic	4427	9121	16340	6.2	3.7
Tire	3485	5984	9640	4.6	3.0
Nontire	3568	7025	14695	5.8	4.7
United States	2305	3179	4350	2.7	2.0
Canada	155	326	580	6.4	3.7
Brazil	93	301	820	10.3	6.5
Mexico	58	163	555	9.0	8.0
Other Latin America	123	250	585	6.1	5.5
European Community	1468	2228	3796	3.5	3.4
Spain	96	252	450	8.5	3.7
Non-EC Other Western Europe	155	249	467	4.0	4.0
USSR	917	2159	3850	7.4	3.7
Other Eastern Europe	440	882	1915	6.0	5.0
Africa-Mideast	148	320	959	6.6	7.1
Japan	519	1220	2250	7.4	3.9
China	210	450	1240	6.6	6.5
Other Asia	267	913	2345	10.6	6.1
Oceania	99	118	173	1.5	2.4
Rubber Production	7020	13064	24335	5.3	4.0
Natural	2576	3815	7995	3.3	4.7
Synthetic	4506	9249	16340	6.2	3.6
Synthetic Production	4506	9249	16340	6.2	3.6
United States	2037	2628	3270	2.1	1.4
Canada	200	283	380	2.9	1.9
Brazil	55	224	515	12.4	5.3
Mexico	18	90	250	14.4	6.6
Other Latin America	18	45	180	7.9	9.1
European Community	892	1859	2900	6.3	2.8
Spain	13	80	230	16.3	6.8
Non-EC Other Western Europe	—	23	120	—	10.9
USSR	653	2025	3360	9.9	3.2
Other Eastern Europe	223	531	1605	7.5	7.2
Africa-Mideast	23	54	385	7.4	13.1
Japan	298	1107	1845	11.6	3.2
China	28	80	320	9.1	9.1
Other Asia	22	177	920	19.0	10.9
Oceania	26	43	60	4.3	2.1

Note: Production and consumption totals may not agree due to change in stocks and statistical discrepancies.

rubber market. In addition, the availability of petrochemical feedstocks at relatively low and stable prices, and technical progress have encouraged production of a wide range of synthetic rubbers.

This has led to synthetic rubber's superior competitive position in several ways. The general-purpose rubbers possess adequate physical properties (with respect to tensile strength, temperature performance, resilience, wear resistance and resistance to environmental factors) and are, in some cases, superior to natural.

They also have a greater degree of consistency and provide a more stable source of supply. Until recently, another factor was their price range, which was an advantage over natural. The specialty synthetics, however, have almost consistently been more expensive than natural. This has not hurt their market share since they are manufactured with special properties which make them highly valuable for certain applications.

Synthetic rubbers require a wide range of petrochemical intermediaries with variations in their methods of production. As a consequence, the general-purpose synthetics (SBR, BR and IR) are usually produced first in any given country. If economic development and market size warrant it, and technology can be obtained, other specialty rubber facilities will then follow. Production in 1979 was supplied by more than one hundred firms, plus state-run operations in Eastern Europe and China.

Total output was more than 9 million metric tons in 1979, representing an increase of over 6% annually since 1966/1968. This will slow to a 3.7% rate in the future with 1995 production anticipated at 16.3 million metric tons. This slowdown will be a combination of higher production costs (in respect to higher petrochemical feedstock prices, capital costs, etc.) and reduced rubber demand, mostly from the tire sector.

The future production growth rate will vary widely among countries. Currently, approximately five countries (which do not presently produce) have production facilities under construction or planned. Others are likely candidates by 1995. **RW**

A BILL PUBLICATION

Rubber World

TECHNOLOGY/MARKETS/NEWS

VOLUME 184, NO. 6

SEPTEMBER 1981

Cryogenic grinding

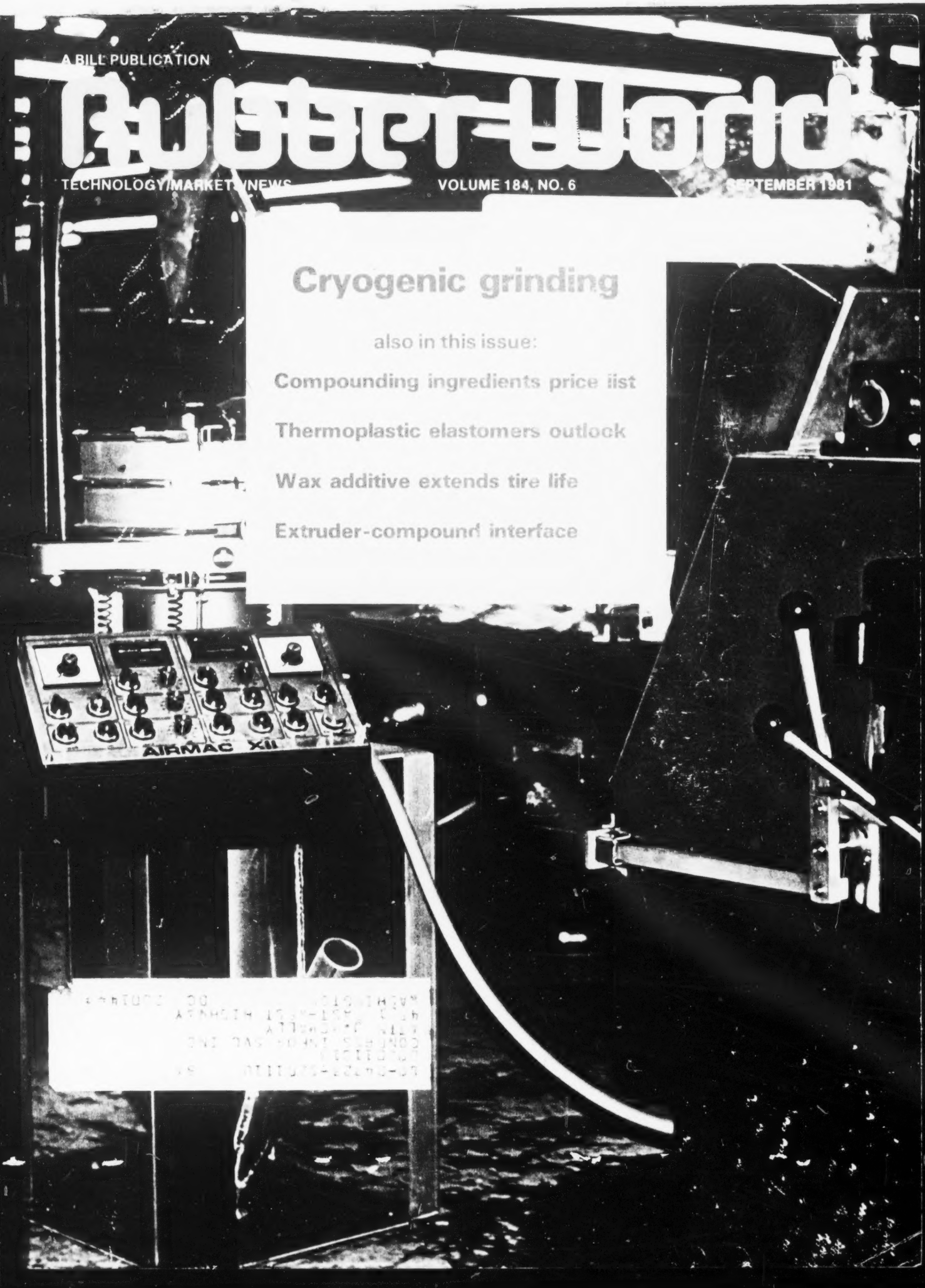
also in this issue:

Compounding ingredients price list

Thermoplastic elastomers outlook

Wax additive extends tire life

Extruder-compound interface



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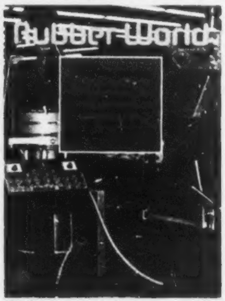

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New cryogenic shot blast deflashing equipment offers an economical and cost-effective method for finishing rubber-molded parts. Cover shot courtesy of Airmac Technology Systems, Inc., Irvine, Calif.

ABP

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Rubber World Stock

		PRICE							TREND TO MARKET				EARNINGS/SHARE				
					Change		52 Week		Price Trend (% per day)		Volume Trend (% per day)			Latest 12 Months vs Preceding 12 Months Change			
Name	Symbol	High	Low	Close	Amt	Pct	High	Low	Last 30 Days	Last 5 Days	Last 30 Days	Last 5 Days	Last Fiscal Year	Amt	Pct	5 Year Annual Growth Rate	Profit Margin
		$	$	$	$	%	$	$	%	%	%	%	$	$	%	%	%
Tires and Inner Tubes																	
Aegis Corp	AO	3.25	2.75	3.25	.50	18.18	3.63	1.50	.06	.92	3.03	-14.79	.18	.00 S	0	-2.0	1.3
Alliance Tire	ATRA	14.63	14.00	14.00	.00	.00	14.63	6.59	-.09	.67	-3.12	72.22	1.30	.87 Q	228.9	106.0	6.2
Armstrong Rub	ARM	37.75	34.63	35.00	-.88	-2.44	39.88	16.13	-.09	-.84	-.18	64.43	-10.17	-7.64 N	-306.8	-36.0	-4.1
Bandag Inc	BDG	24.88	23.38	23.88	-.50	-2.05	27.63	18.13	-.15	-.20	-4.96	-58.91	2.27	.37 S	17.8	12.0	8.3
Cooper Tire	CTB	38.63	36.38	36.63	.38	1.03	42.00	10.75	.03	-.37	-4.40	10.38	6.17	7.08 S	337.1	16.0	4.0
Dunlop Holding	DLP	1.50	1.31	1.38	.00	.00	1.94	1.31	-.35	-.22	6.59	47.37	-.67	-.71 F	-775.0	-30.0	-1.1
Firestone Tire	FIR	12.38	11.13	11.38	-.88	-7.14	13.75	7.75	-.38	-.39	1.72	-2.50	-2.11	.78 S	NE	-41.0	-2.5
Gen Tire	GY	26.63	25.25	26.00	-.25	-.95	29.50	17.16	-.31	.53	-7.82	2.43	1.68	1.89 S	150.0	-15.0	1.8
Goodrich B F	GR	24.50	22.88	23.13	-.38	-1.60	28.13	20.13	-.34	.06	-2.00	4.07	3.57	-.13 S	-3.5	23.0	2.0
Goodyear Tire	GT	20.00	18.63	19.13	.50	2.68	20.25	15.00	.10	.26	.75	12.63	2.85	1.58 S	98.1	9.0	2.4
Mohawk Rub	MWK	16.50	14.63	14.63	-1.38	-8.59	23.75	8.66	.26	-1.55	-3.90	10.67	2.57	1.96 S	107.6	4.0	2.6
Uniroyal Inc	R	9.75	8.38	8.38	-.63	-6.94	10.38	4.38	-.14	-.67	2.51	60.80	-.29	6.22 S	NE	NE	-.3
Rubber Products																	
Amerace Corp	AAE	21.13	20.25	20.63	-.38	-1.79	25.25	18.25	-.11	.59	-2.86	-16.35	2.84	-.30 S	-9.4	4.0	3.1
Am Biltrite	ABL	12.88	11.00	12.13	1.13	10.23	12.88	6.25	.21	.42	-5.06	-59.09	-4.78	-5.33 Q	-658.0	NE	-6.2
Carlisle Corp	CSL	38.00	33.63	33.63	-2.88	-7.88	54.75	18.19	-.66	.32	-3.26	-27.17	2.78	1.21 S	53.7	44.0	6.8
Dana Corp	DCN	28.88	27.38	27.75	.75	2.78	33.50	20.13	.00	.52	-2.03	.08	2.78	-2.88 Q	-57.9	-6.0	3.8
Dayco Corp	DAY	13.75	12.13	13.00	-.13	-.95	14.38	11.00	-.02	.19	-4.33	-4.58	1.10	-.96 S	-51.3	-11.0	1.2
Grt Amer Ind	GRI	14.75	12.63	13.63	-.75	-5.22	18.88	11.38	-.50	2.09	3.82	-58.40	4.08	-.22 S	-5.5	22.0	5.7
OSullivan Cp	OSL	17.31	14.81	16.88	2.06	13.92	17.31	8.19	.58	.81	-7.60	20.00	1.74	.52 S	35.1	9.0	6.7
Pantasote Inc	PNT	5.88	5.00	5.63	-.13	-2.17	6.25	2.84	-.25	2.71	-6.02	-6.88	.30	.10 Q	28.5	-18.0	.8
Plymth Rub A	PLRA	6.25	5.88	6.00	-.38	-5.88	7.63	2.25	-.90	.05	-6.20	.00	.02	.10 S	100.0	82.0	.2
Plymth Rub B	PLRB	5.38	4.88	5.00	-.25	-4.76	7.38	1.88	-.94	-.06	-7.00	-83.33	NA	NA	NA	NA	NA
Rubbermaid	RBD	34.63	33.25	33.63	.38	1.13	39.50	22.75	.04	.20	8.70	9.27	2.61	.16 S	5.7	11.0	6.5
West Co	WST	31.38	27.63	27.63	-2.25	-7.53	33.25	17.25	.29	-.92	-.53	30.68	2.55	.79 S	36.0	16.0	6.7

(KEY: NA—Not Applicable NC—Not Calculable NE—Negative Earnings)
Q—First quarter S—Six months N—Nine months F—Fiscal year
**—Other than a quarterly multiple resulting from a fiscal year change*
Table prepared by Media General Financial Services, Richmond, Va. 23261

Financial statements

AccuRay reported total 1980 operating revenues of $102.9 million that produced a net income of $2,360,000 or 68 cents per share. The final 1980 quarter provided revenues of $27.8 million and net income of $688,000 or 20 cents per share.

BASF reported 1980 world sales of $16.5 billion and Group sales of $15.2 billion. The latter produced earnings before taxes totaling $698 million. For its first 1981 quarter, the Group announced pre-tax earnings of $213 million from net sales of $3.9 billion. World sales came to $4,151 million.

First half sales for **BASF AG** reached approximately $6.92 billion, the West German chemical group reported.

Net earnings from **Carlisle's** first 1981 quarter were reported at $8,465,000, or 90 cents per share, on sales of $101,975,000. The company's second quarter resulted in sales of $107,861,000 that produced $9,728,000, or $1.04 in earnings. Six-month figures show sales totaling $209,836,000, and net earnings, $18,193,000, or $1.94 per share.

Second quarter 1981 produced a net income of $90.5 million, or $1.09 a share for **Cities Service**. The company's six-month net income came to $148.2 million, or $1.78 a share.

In another statement, the company announced a

Summary

P/E	DIVIDENDS			FINANCIAL POSITION					
							(Last Fiscal Year) Per Share		
P/E Ratio Today	Indicated Dvd Rate		Last X Dvd Date	(Last Fiscal Year) in $Millions		Current Ratio	Long Term Debt	Stock Equity	Last Bal Sheet Date
	Amt	Yield		Revenue	Earnings				
	$	%		$	$		$	$	
11.6	.00	0	00-00-00	147.0	1.9	2.3	1.7	3	1280
11.2	.00	0	06-26-81	62.8	3.9	1.2	6	5	1280
NE	1.40	4.0	06-01-81	401.3	-16.4	2.5	48.5	59	0980
9.8	.80	3.4	06-16-81	330.9	27.4	3.3	1.2	13	1280
4.0	.90	2.5	06-01-81	324.0	12.8	2.2	27.4	32	1280
NE	.08	5.8	05-26-81	3311.2	-35.8	1.6	4.6	6	1280
NE	.45	4.0	06-26-81	4850.5	-122.0	1.5	10.4	23	1080
8.3	1.50	5.8	07-30-81	2215.2	40.8	1.9	9.7	40	1180
6.6	1.56	6.7	08-31-81	3079.6	61.7	1.9	31.2	55	1280
6.0	1.30	6.8	08-10-81	8444.0	206.7	2.1	17.3	32	1280
3.9	.90	6.2	08-31-81	180.7	4.7	2.2	11.5	22	1280
7.7	.00	.0	08-22-78	2299.5	-7.8	2.0	19.8	16	1280
7.2	1.32	6.4	06-09-81	326.4	10.1	3.2	21.1	45	1280
NE	.30	2.5	06-16-81	207.6	3.3	2.3	10.8	21	1279
9.7	.88	2.6	08-11-81	380.8	25.8	2.3	4.6	11	1280
13.3	1.60	5.8	08-21-81	2524.0	95.7	2.1	9.7	28	0880
14.3	.56	4.3	06-30-81	716.4	8.6	2.2	29.9	26	1080
3.6	.00	0	00-00-00	115.3	6.6	2.2	9.2	19	1280
8.4	.60	3.6	09-09-81	60.8	4.1	3.3	0	9	1280
12.5	.00	0	12-24-80	148.7	1.2	1.6	3.9	8	1280
30.0	.00	.0	00-00-00	63.8	.1	1.5	.0	7	1180
NA	.00	0	00-00-00	NA	NA	NA	NA	NA	NA
11.5	1.08	3.2	08-10-81	308.9	20.1	1.9	2.0	18	1280
9.3	.60	2.2	07-08-81	148.2	9.9	2.1	3.3	17	1280

All information in this table is based on sources believed to be reliable, but its accuracy is not guaranteed. Every effort will be made to correct errors, when discovered in future editions.

40-cents-per-share dividend on common stock. It is payable September 8 to shareholders of August 10 record.

Dunlop reported 1980 sales of £1386 million with operating profit amounting to £50 million.

General Tire and Rubber has announced a $1.25-per-share quarterly cash dividend on the issued and outstanding $5 cumulative preference stock. A regular cash dividend of $1.1875 per share has been placed on the issued and outstanding 4.75% cumulative preference stock. Both are payable September 30 to holders of record September 2.

BFGoodrich has announced a 39-cents-a-share regular dividend on its common stock; $1.9625 on the $7.85 cumulative preferred/Series A; $.24375 on the $.975 cumulative preferred/Series B; and $.78125 on the $3.125 cumulative convertible preferred stock/Series C; all of which are payable September 30 to shareholders of September 4 record.

Goodyear Tire and Rubber has announced a 32.5-cents-per-share regular quarterly dividend, representing an annual rate of $..30 a share. It is payable September 15 to holders of August 14 record.

Gulf Oil's quarterly dividend has been increased by 12% in a recent stock repurchase plan covering up to 10 million shares of common stock. The new 70-cent-per-share dividend was previously 62½ cents. It is payable September 10 to holders of August 7 record. This is the eighth increase since 1974.

Hercules declared a 3-cent-per-share dividend increase on its common stock, raising it to 33 cents a share. To date, that makes the yearly total of 93 cents. It is payable September 25 to holders of record September 4.

Hoechst Group reported 1980 worldwide sales of $16.3 billion, producing net profits of $304 million. For the first 1981 quarter, the Group announced worldwide sales of $4.074 billion. Profits were not released. (Deutsche Marks converted to dollars: $1.00 = 2.079 Marks.)

Imperial Chemical Industries of London reported a first quarter net income of $21.4 million, or approximately 4 cents a share on sales of $3.20 billion. This current profit follows a net loss for the entire 1980 year.

Sales for **Nalco Chemical's** first quarter 1981 quarter came to $156.8 million. Net earnings were reported at $19.2 million, or 95 cents a share.

Park-Ohio reported first quarter net sales of $57,078,515 producing net earnings of $2,355,771, or 41 cents per share fully diluted. For its first six months, the company announced net sales totaling $109,987,844 with net earnings amounting to $4,687,221 or 82 cents per share fully diluted.

In other financial news, a 15-cent-per-common-share and a 19-cent-per-preferred regular-quarterly dividend has been announced, both payable September 15 to stockholders of September 1 record.

Second quarter net income from **Pfizer's** continuing operations were a reported $64.7 million or 85 cents a share on sales of $797.8 million. The first six months produced sales of $1608.1 million, net income of $139.5 million and $1.85 per share.

In another financial statement, Pfizer declared a 40-cent-per-share quarter dividend on common stock. It is payable September 21 to shareholders of August 19 record.

Polysar reported total 1980 revenues of $1,180 million from $1,170 million in sales and $10 million in interest and other income. Income came to $73 million.

Thiokol's reported first quarter 1981 sales of $178.7 million produced net earnings of $8.5 million, or 73 cents per share.

U.S. & World Rubber News

IISRP tempers rubber consumption forecast

AKRON — A less optimistic forecast for synthetic rubber consumption was released by the International Institute of Synthetic Rubber Producers. The new figures call for a 4.2% increase in demand per year until 1990 when consumption is expected to be around 12.6 million metric tons.

Last year, the statistical committee for the Institute forecast consumption would reach 13.7 mmt with a 5.2% annual increase. The committee tempered its outlook this year as consumption levels in the non-centrally planned economies slowed.

Forecasted consumption of new rubber (in thousand metric tons)

Area	1980	1981	1985	1990
Non CPEC				
Synthetic Rubber	5,634	5,940	7,021	8,263
Natural Rubber	2,955	3,064	3,535	4,175
Total New Rubber	8,589	9,004	10,556	12,438
% Synthetic	65.6	66.0	66.5	66.4
Eastern Europe				
Synthetic Rubber	2,650	2,800	3,350	4,100
Natural Rubber	425	430	400	350
Total New Rubber	3,075	3,230	3,750	4,450
% Synthetic	86.2	86.7	89.3	92.1
China/Asian CPEC				
Synthetic Rubber	111	116	170	274
Natural Rubber	406	456	525	613
Total New Rubber	517	572	695	887
% Synthetic	21.4	20.3	24.4	30.9
Total CPEC				
Synthetic Rubber	2,761	2,916	3,520	4,374
Natural Rubber	831	886	[illegible]	963
Total New Rubber	3,592	3,8[illegible]2	4,445	5,337
% Synthetic	76.9	76.7	79.2	82.0
Total World				
Synthetic Rubber	8,395	8,856	10,541	12,637
Natural Rubber	3,786	3,950	4,360	5,138
Total New Rubber	12,181	12,806	14,901	17,775
% Synthetic	68.9	69.2	70.7	71.1

New rubber consumption forecast — Worldwide forecast by region (excluding CPEC) (1000 metric tons)

	1980	1981	1985	1990
Synthetic Rubber				
North America	2,127	2,308	2,665	2,946
W. Europe, Africa, M. East	1,677	1,719	1,963	2,208
Austral/Asia	1,291	1,335	1,614	1,974
Latin America	539	578	779	1,135
Natural Rubber				
North America	710	768	874	957
W. Europe, Africa, M. East	1,015	1,020	1,135	1,272
Austral/Asia	1,032	1,066	1,243	1,543
Latin America	198	210	283	403
Total Rubber				
North America	2,837	3,076	3,539	3,903
W. Europe, Africa, M. East	2,692	2,739	3,098	3,480
Austral/Asia	2,323	2,401	2,857	3,517
Latin America	737	788	1,062	1,538
World (Excluding CPEC)	8,589	9,004	10,556	12,438

Largest revisions in consumption forecast were for North America, over 300 thousand metric tons lower, and the Australian-Asian region down 191 tmt.

The IISRP also sees consumption of natural rubber increasing less than what they felt the year before with overall world consumption in 1990 to be in the range of 5.1 mmt, down 75 tmt.

The individual polymers slated for the best growth were ethylene/propylene, polyisoprene and polybutadiene with all better than a 5% yearly increase in consumption. SBR is expected to continue to account for almost 55% of synthetic rubber consumption with polybutadiene accounting for 17%.

On a worldwide basis, the Institute sees the percentage use of synthetic to increase more than 2% to 71.1% of all rubber consumed in 1990.

Predicasts, a market and research firm, gives a somewhat different forecast, stating that natural rubber consumption will outpace synthetic, reversing the historical trend. Predicasts says synthetic growth will slow because of petroleum-motivated price increases and that by 1995 NR will account for 33% of all rubber consumed.

Predicast says in addition to price competitiveness, NR will also benefit from comparative price stability due primarily to the International Rubber Agreement. Predicasts researchers said that accord "set the mood for expansion of the natural rubber industry."

There is some concern, however, from natural rubber producing nations that the agreement might already be outdated. In May, a Malaysian Industries Minister told the governing council that the present price range has already gone out of line with production costs and called for a review on the price range.

Although synthetic rubber consumption is expected to grow at a slower rate worldwide, it is expected to increase its percentage in the centrally planned economic countries of Eastern Europe, China and Asia.

New rubber consumption forecast — Worldwide forecast by type (excluding CPEC) (1000 metric tons)

Type	Estimate 1980	1981	1985	199
SBR — Dry Rubber	[illegible]	2,878	3,400	3,95
SBR — Latex	[illegible]	455	534	61
Polybutadiene	910	960	1,152	1,39
Polyisoprene	[illegible]	248	295	35
Ethylene-Propylene	[illegible]	340	424	51
Polychloroprene	[illegible]	287	327	37
Butyl	[illegible]	427	492	57
Nitrile (Dry & Latex)	[illegible]	192	228	2
Other Synthetic	[illegible]	136	173	22
Total Synthetic	[illegible]	5,940	7,021	8,2
Natural	[illegible]	3,064	3,535	4,17
Total New Rubber	[illegible]	9,004	10,556	12,43
% Synthetic	[illegible]	66.0	66.5	66.

China and the Asian countries, which have NR production, are expected to increase SR consumption to almost 31% of all rubber in 1990. The Eastern European countries are expected to cutback on NR imports and increase SR consumption to over 92% of all rubber by 1990.

The growing use of synthetics in tire production in this region has led to such a ratio. A study of Landell Mills Commodities shows for the past ten years there has been a continuous decline in the amount of natural rubber imported per tire produced. LMC says the USSR used 10 kg. of natural rubber in 1970 to 3.3 kg. in 1980. For other Eastern European countries the decline was from 11.6kg to 6.7kg.

One reason given for the decline is the rapid growth in polyisoprene production. LMC claims the natural rubber is now only 7% of total rubber used in Soviet tires.

New Goodrich division targeted for high growth

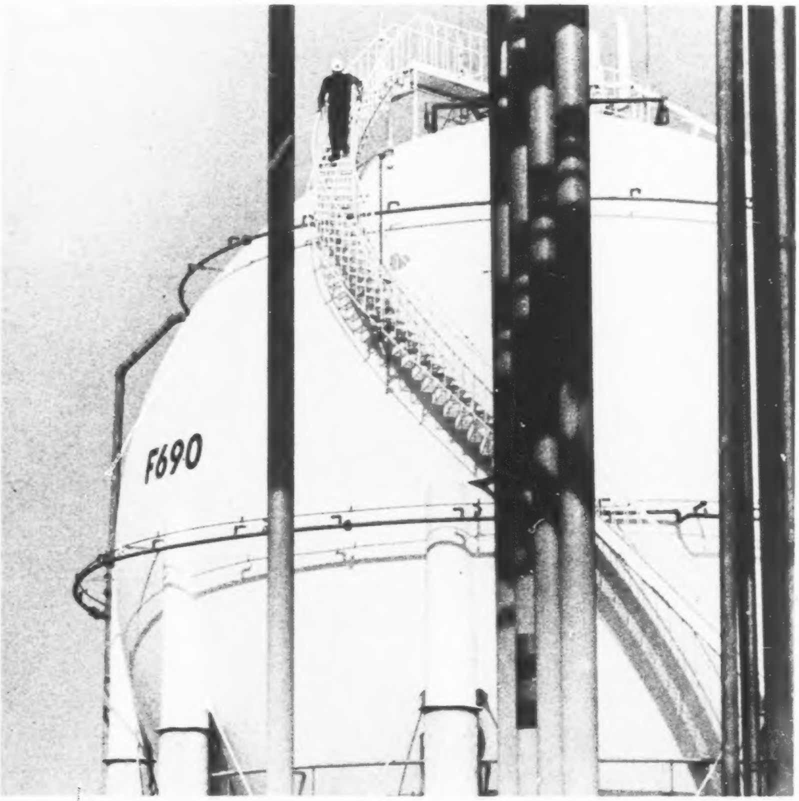
CLEVELAND, OH — BFGoodrich combined product lines from its specialty polymers group and plastic division to form a division they target for strong growth in the next decade.

Products comprising the new Specialty Polymers and Chemicals Division include polymers used in adhesives, metal coatings and rubber and plastic modification; hydrophilic polymers, and thermoplastic polyurethane and chlorinated polyvinyl chloride.

Kent Lee, Jr., senior vice president of the division, says there will be heavy emphasis on product testing and application engineering for customers. "These products are used in diverse applications and are chemically distinct, and the special marketing and sales techniques required to reach the users of these materials are also distinct," he said.

Lee said by consolidating these units, BFG expects to dramatically increase the sales contribution of these products to the company.

Within the past year, Goodrich announced plans to expand manufacturing capacity in four of the product lines involved in the new division. BFG's Estane® polyurethane capacity will increase 30%; Carbopol® resins will double capacity; production capability for Carboset® resins and Good-rite® K-700 polyacrylates will increase three-fold.



HIGHLY REFINED isoprene in this 640,000-gallon tank at Goodyear's Beaumont, Texas, chemical plant is a key factor in the long service life of today's passenger, truck, bus and airplane tires. IISRP figures Isoprene consumption will grow about 5.7% per year through 1990.

RAPRA to update compounding review

The Rubber and Plastics Research Association is looking for companies involved in rubber manufacturing or compounding that are willing to sponsor the updating of a review of the literature on the dispersion of particulate materials in rubber. The original review was prepared in 1974 by a group of 20 companies from Europe and North America. As part of the agreement for this first review, the information was not made available. Now terms for disclosure have been agreed on and further work is needed to bring the review up to date. Copies of some key items of literature on mixing will be supplied with the completed review, one of which will cover the two years of initial research.

Outlook for thermoplastic elastomers

by Luke E. Fithian, Business Manager, Thermoplastic Rubber, Uniroyal Chemical Company, Naugatuck, CT

In spite of maturing U.S. markets for many products in the 1980's, thermoplastic elastomers should perform well in this decade.

According to Data Resources, Inc., a Boston, Mass., consulting firm, there will be fairly slow and cyclic growth in the economy plus high and potentially-volatile inflation through 1990 owing to continually-increasing capital, labor, and energy costs. Concurrently, economic growth will slow considerably from what it was in the past two decades, owing to a maturing U.S. market.

Market share in the 1980's will continue to be an important factor in profitability, but it should not be overestimated. The strategic impact of cost inflation — particularly the impact of cost inflation in market segments where technologies are more heavily-leveraged by energy and labor as in thermoset rubbers — will make it more difficult to maintain current profitability levels. Where these conditions occur in fairly mature markets, acceptable profitability levels seem unlikely, given the inflation rate and the cost of capital to replace obsolete equipment.

Cost Comparison: TPR® vs. Rubber
3½" Production Lines — 16-3SJ

Output	C.V. 30.6M Feet	TPR® 53.6M Feet
	COST/1000'	
Variable Cost:		
Materials		
Copper	$22.23	$22.23
Compound	13.95	20.98
Labor	7.95	4.48
Utilities	2.15	0.95
Total Variable Cost	46.28	48.64
Fixed Cost	8.50	5.06
Total Cost	$54.78	$53.70

Domestic Product Arena — 1978

Thermoplastic		Rubber	
PVC	5,800	SBR	3,100
PS	3,870	Natural	1,700
LDPE	7,100	P.B.D.E.	900
HDPE	4,200	Nitrile	160
PP	3,000	E.P.D.M.	310
ABS	1,100	Butyl	325
PVAC	710	Neoprene	285
SBR	650	Hypalon	70
Other	1,070	Other	170
Total	27,500	Total	7,000

TPE'S	
SBC	165
TPU	48
TPO	37
Polyestor	9
Other	6
Total	265

Sources: Smithers & Fairfield, R.M. Kossoff & Associates Multiclient Study, Chemical Division Market Research, SPI

What this means is that the situation may be tailormade for thermoplastic elastomers.

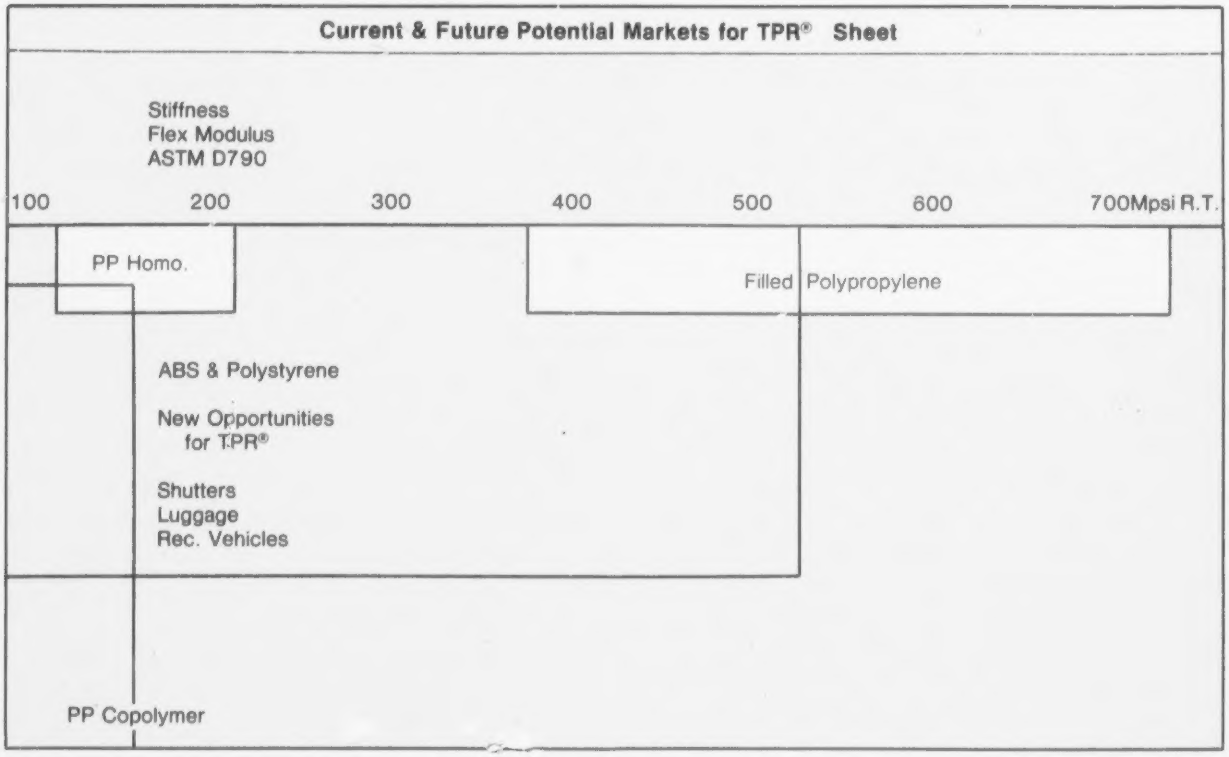
Thermoplastic elastomers are based on technologies that have inherently higher labor productivity and lower energy requirements. The cost advantage of thermoplastic elastomers over thermosets should show considerable improvement through this decade. In technologies where the performance properties of thermoplastic elastomers are adequate for the end use application, thermoset materials will find it very difficult to be price competitive.

At present, the total U.S. market for all thermoplastic materials is about 28 billion pounds, four times larger than the market for thermoset materials at 7 billion pounds. However, although thermoplastic elastomers remain a fairly small market at about 270 million pounds per year, the growth rate for thermoplastic elastomers has been high — at about 15% to 20% per year — for the past five years.

Thermoplastic elastomers are many and varied. Styrene butadiene block copolymers have been the largest volume TPE's; having developed substantial business in the areas of footwear, adhesives and viscosity-index modifiers for lubricating oils. Broken into saturated and unsaturated types, of which the latter are the largest volume, they are highly extensible, show good physical properties, but poor to moderate weather aging.

Thermoplastic polyesters have found their niche where their high oil resistance and high stiffness are desirable. Since they have outstanding tensile properties as well as temperature resistance, their uses are especially applicable to the higher-performance segments of the thermoplastic elastomer market.

Thermoplastic polyurethanes show outstanding abrasion resistance. However, they are somewhat limited in terms of their lower tem-


Current & Future Potential Markets for TPR® Sheet

perature resistance and constitute a relatively mature market.

Thermoplastic olefins have found broad applications in automotives, wire and cable, and mechanical goods. These are the second largest volume thermoplastic elastomer type, ranking behind only styrene-butadiene.

Thermoplastic olefins are divided into two distinctly different types of materials — those that are partially cured and those that are mechanical blends of EPR rubbers and polyalpha-olefins.

Partial curing of such materials, using patented technology, has resulted in substantial improvements in temperature deformation properties, mold cycling properties, and surface appearance characteristics. In addition, the dynamic curing, which partially vulcanizes the rubber phase, dampens the processing variability making the materials superior from the standpoint of consistency of performance.

Thermoplastic elastomers such as TPR® offer technical and design opportunities which can enable processors to reassess how to make certain end products. For example, by combining thermoplastic olefins and filled polypropylene, we can achieve physical properties that approximate those of acrylonitrile-styrene-butadiene plastics. In some cases, the result can be substantially improved impact properties at considerable cost savings over ABS.

Thermoplastic elastomers also offer financial advantages to the producer because of their lower capital costs for new investment — injection molding equipment versus vulcanizing equipment — and the higher profitability and return on that investment. TPE's are processed in the same equipment as PVC but, since the end product appears and performs like many rubbers, the perceived value, and therefore the price and profitability can be much higher at only slightly more cost than PVC to the producer.

Consequently, thermoplastic elastomers will offer producers the opportunity to improve their profitability over existing thermoset and thermoplastic systems. They will also give end users products with high performance levels. While we do not foresee that thermoplastic elastomers will replace rubber, we do anticipate that they will find increasing penetration of thermoset markets where the overall cost performance of TPE's shows them to be adequate for the ultimate end use.

Alternatives to PVC

Thermoplastic elastomers should be used "when neither a rubber nor a plastic will do." They provide the advantages of thermoset rubber, but with the manufacturing economics of plastics.

For example, TPR was compared in two cases to polyvinyl chloride (PVC) plastic and to thermoset rubber in a submersible pump cable application. Uniroyal's market development group polled the industry which used the product to learn the properties that are important.

The survey showed that there were differences in perceived value of the products between the market segment that used rubber and the segment that used plastic.

The TPR was then rated against these industry standards and compared to the PVC and SBR neoprene. From this data, an overall performance index was developed that compared the economics of production for the plastic and the thermoset and a cost-performance index was derived.

These calculations showed that TPR is an acceptable alternative to both plastic and rubber, and its economics strongly favored its use over that of neoprene rubber.

Against PVC, the initial problem with TPR was getting it to adhere to the wire with the same degree of bonding as plastic. Redesign of the wall thickness, however, gave comparable economics. As a result of the improved performance of the TPR, Underwriters Laboratories granted approval for Uniroyal TPR use at a 32 mil wall thickness. **RW**

A BILL PUBLICATION

Rubber World

TECHNOLOGY/MARKETS/NEWS VOLUME 185, NO. 1 OCTOBER 1981

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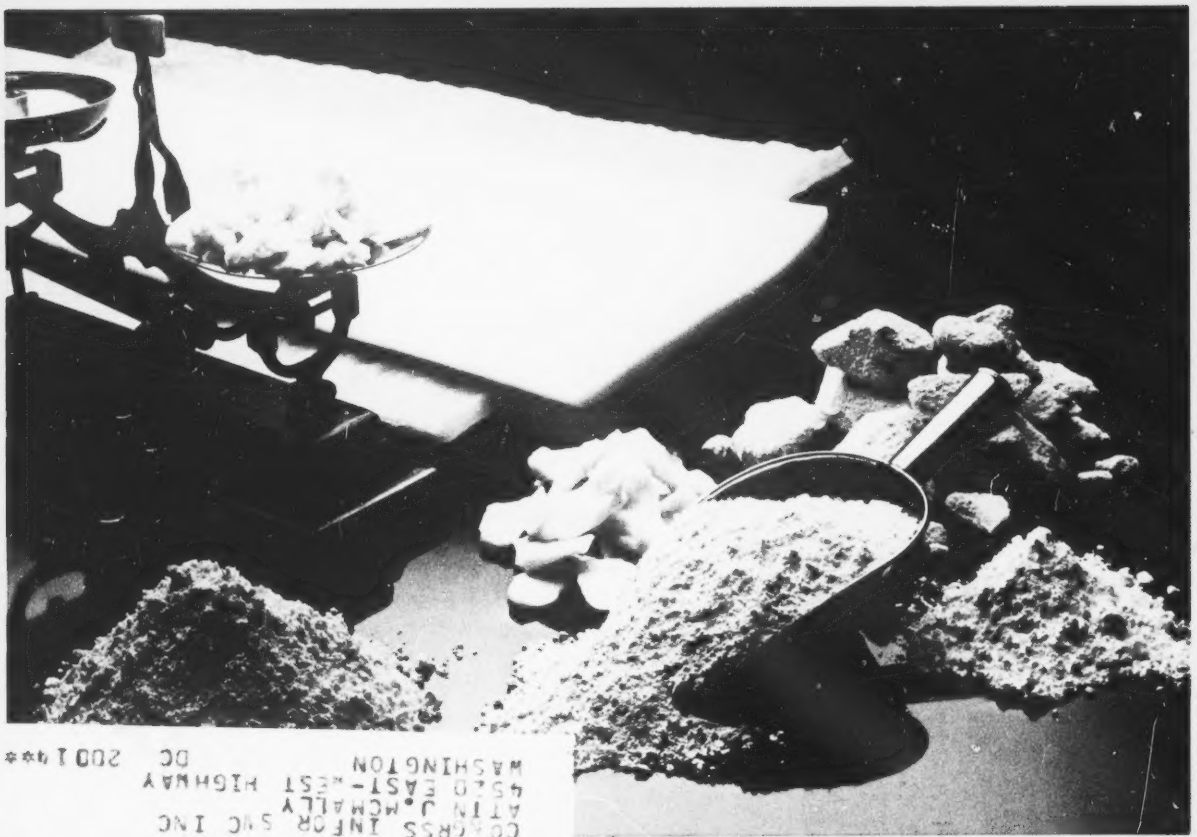
Annual rubber chemical report

Pricing, availability pose potential problems



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WASHINGTON DC 20014**

also: Mold release agents

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Compounding with color

Extender oils for synthetic rubber

Chemical & material corporate profile 1981

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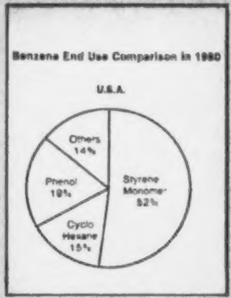
Cover courtesy of Central Rubber Co., Northbrook, Ill.



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Rubber World Stock

		PRICE							TREND TO MARKET				EARNINGS/SHARE				
					Change		52 Week		Price Trend (% per day)		Volume Trend (% per day)			Latest 12 Months vs Preceding 12 Months Change			
Name	Symbol	High	Low	Close	Amt	Pct	High	Low	Last 30 Days	Last 5 Days	Last 30 Days	Last 5 Days	Last Fiscal Year	Amt	Pct	5 Year Annual Growth Rate	Profit Margin
		$	$	$	$	%	$	$	%	%	%	%	$	$	%	%	%
Tires and Inner Tubes																	
Aegis Corp	AO	3.25	2.75	2.75	-.50	-15.38	3.63	1.75	.08	-.49	-1.10	16.95	.18	.00 S	.0	-2.0	1.3
Alliance Tire	ATRA	14.13	13.25	13.50	-.50	-3.57	14.63	6.59	.35	.76	3.20	-3.57	1.30	1.00 S	303.0	104.0	6.2
Armstrong Rub	ARM	35.38	32.00	32.75	-2.50	-7.09	39.88	16.13	.01	.39	1.41	11.24	-10.17	-7.64 N	-306.8	-36.0	-4.1
Bandag Inc	BDG	23.75	20.00	21.75	-2.13	-8.90	27.63	19.75	-.21	2.06	7.41	-89.07	2.27	.37 S	17.8	12.0	8.3
Cooper Tire	CTB	17.88	13.13	14.13	-3.88	-21.53	21.00	6.38	-.78	-.22	3.83	-12.62	3.09	3.55 S	338.0	16.0	4.0
Dunlop Holding	DLP	1.50	1.25	1.25	-.06	-4.76	1.94	1.25	.05	.00	-2.38	-47.73	-.67	-.71 F	-775.0	-30.0	-1.1
Firestone Tire	FIR	11.00	10.00	10.88	-.38	-3.33	13.75	8.13	.05	.84	-.36	15.40	-2.11	1.27 N	NE	-38.0	-2.5
Gen Tire	GY	25.50	24.25	24.88	-.50	-1.97	29.50	17.16	.27	.44	1.41	-36.96	1.68	1.89 S	150.0	-15.0	1.8
Goodrich B F	GR	23.63	21.38	22.75	-.38	-1.62	28.13	20.13	.27	1.54	3.59	35.51	3.57	-.13 S	-3.5	23.0	2.0
Goodyear Tire	GT	19.13	17.75	17.88	-1.13	-5.92	20.25	15.00	.11	-.03	-3.20	-12.25	2.85	1.58 S	98.1	9.0	2.4
Mohawk Rub	MWK	15.25	13.50	14.50	-1.13	-7.20	23.75	8.66	-.04	1.80	4.08	-63.02	2.57	1.96 S	107.6	4.0	2.6
Uniroyal Inc	R	8.88	7.38	8.25	-.63	-7.04	10.38	4.38	-.08	-.07	1.35	-70.79	-.29	6.22 S	NE	NE	-.3
Rubber Products																	
Amerace Corp	AAE	20.00	18.13	18.50	-1.75	-8.64	25.25	18.13	.00	.67	-1.91	-1.16	2.84	-.30 S	-9.4	4.0	3.1
Am Biltrite	ABL	11.75	10.75	10.75	-1.13	-9.47	12.88	6.25	-.09	-.29	-3.03	21.05	-4.78	-3.47 S	NE	NE	-6.2
Carlisle Corp	CSL	35.00	26.25	32.63	-2.63	-7.45	54.75	26.25	-.14	2.38	2.90	-7.68	2.78	1.21 S	53.7	44.0	6.8
Dana Corp	DCN	27.25	24.38	25.00	-2.25	-8.26	33.50	20.13	-.07	.50	.21	25.46	2.78	-2.88 Q	-57.9	-6.0	3.8
Dayco Corp	DAY	14.75	12.50	14.50	1.00	7.41	14.75	11.00	.70	2.75	4.44	33.08	1.10	-.46 N	-32.6	-10.0	1.2
Grt Amer Ind	GRI	13.75	12.00	12.88	-1.13	-8.04	18.88	12.00	.24	1.39	-3.55	-27.50	4.08	-.22 S	-5.5	22.0	5.7
OSullivan Cp	OSL	16.50	15.13	15.38	-1.25	-7.52	17.31	8.63	.02	.51	-.63	-75.00	1.74	.52 S	35.1	9.0	6.7
Pantasote Inc	PNT	5.63	4.88	5.00	-.75	-13.04	6.25	2.84	.07	.62	-4.35	-29.35	.30	.69 S	380.0	-12.0	.8
Plymth Rub A	PLRA	5.88	4.88	4.88	-1.13	-18.75	7.63	3.00	-.25	-.89	4.48	95.00	.02	.10 S	100.0	82.0	.2
Plymth Rub B	PLRB	5.00	4.38	4.38	-.63	-12.50	7.38	2.25	.08	-.25	4.57	77.78	NA	NA	NA	NA	NA
Rubbermaid	RBD	32.50	30.13	31.25	-1.50	-4.58	39.50	22.75	.03	1.10	-5.49	24.15	2.61	.16 S	5.7	11.0	6.5
West Co	WST	27.63	25.25	26.13	-1.63	-5.86	33.25	18.50	-.18	.62	3.17	-32.78	2.55	.79 S	36.0	16.0	6.7

(KEY: NA—Not Applicable NC—Not Calculable NE—Negative Earnings)
Q—First quarter S—Six months N—Nine months F—Fiscal year
**—Other than a quarterly multiple resulting from a fiscal year change*
Table prepared by Media General Financial Services, Richmond, Va. 23261

Financial statements

For its three months ended March 31, **Alliance Tire and Rubber** reported net sales of IS. 171,470,000 and net profit of IS. 8,149,000. Earnings per share came to IS. 3.03. (March 31, 1981 rate of exchange: IS. 8.826 = $1)

American Cyanamid reported first quarter 1981 net income of $47.1 million, or 98 cents per share on sales of $887 million. For its second quarter, the company announced net income of $42.2 million, or 88 cents per share on $900 million in sales. Net income for its first six months came to $89.3 million, or $1.86 per share.

Consolidated net sales of $85,830,000 for **Bandag's** second 1981 quarter produced net earnings of $7,389,000, or 61 cents per share. Six months consolidated net sales of $165,592,000 made $13,521,000 in net earnings, or $1.12 per share.

In another financial statement, a 20-cents-per-share cash dividend was declared on the company's regular quarterly stock. It is payable October 21 to holders of September 21 record.

For the year 1980, **Bekaert Group's** consolidated turnover was reported at BF 27,669 million, with consolidated net profit at BF 293 million. Depreciation fell to BF 1,154 million from BF 1,174 million in 1979.

Bridgestone Tire reported 1980 consolidated sales of

Summary

P/E		DIVIDENDS		FINANCIAL POSITION					
P/E Ratio Today	Indicated Dvd Rate Amt	Indicated Dvd Rate Yield	Last X-Dvd Date	(Last Fiscal Year) In $Millions Revenue	(Last Fiscal Year) In $Millions Earnings	Current Ratio	(Last Fiscal Year) Per Share Long Term Debt	(Last Fiscal Year) Per Share Stock Equity	Last Bal. Sheet Date
	$	%		$	$		$	$	
9.8	.00	.0	00-00-00	147.0	1.9	2.3	1.7	3	1280
10.2	.00	.0	06-26-81	62.8	3.9	1.2	.6	5	1280
NE	1.40	4.3	08-27-81	401.3	-16.4	2.5	48.5	59	0980
8.9	.80	3.7	09-15-81	330.9	27.4	3.3	1.2	13	1280
3.1	.54	3.8	08-31-81	324.0	12.8	2.2	13.7	16	1280
NE	.08	6.4	05-26-81	3311.2	-35.8	1.6	4.6	6	1280
54.4	.45	4.1	06-26-81	4850.5	-122.0	1.5	10.4	23	1080
7.9	1.50	6.0	07-30-81	2215.2	40.8	1.9	9.7	40	1180
6.5	1.56	6.9	08-31-81	3079.6	61.7	1.9	31.2	55	1280
5.6	1.30	7.3	08-10-81	8444.0	206.7	2.1	17.3	32	1280
3.8	.90	6.2	08-31-81	180.7	4.7	2.2	11.5	22	1280
7.6	.00	.0	08-22-78	2299.5	-7.8	2.0	19.8	16	1280
6.4	1.32	7.1	09-22-81	326.4	10.1	3.2	21.1	45	1280
NE	.30	2.8	06-16-81	201.7	-12.6	2.0	9.6	16	1280
9.4	.88	2.7	08-11-81	380.8	25.8	2.3	4.6	11	1280
12.0	1.60	6.4	08-21-81	2524.0	95.7	2.1	9.7	28	0880
15.3	.56	3.9	06-30-81	716.4	8.6	2.2	29.9	26	1080
3.4	.00	.0	00-00-00	115.3	6.6	2.2	9.2	19	1280
7.7	.60	3.9	09-09-81	60.8	4.1	3.3	.0	9	1280
6.8	.00	.0	12-24-80	148.7	1.2	1.6	3.9	8	1280
24.4	.00	.0	00-00-00	63.8	.1	1.5	.0	7	1180
NA	.00	.0	00-00-00	NA	NA	NA	NA	NA	NA
10.7	1.08	3.5	08-10-81	308.9	20.1	1.9	2.0	18	1280
8.8	.60	2.3	07-08-81	148.2	9.9	2.1	3.3	17	1280

All information in this table is based on sources believed to be reliable, but its accuracy is not guaranteed. Every effort will be made to correct errors, when discovered in future editions.

$3,002 million and profits of $258.3 million, or 29 cents per share.

Directors for **Cooper Tire and Rubber** have announced a two-for-one stock split in the form of a 100% stock distribution and a 20% dividend increase as a result of increased sales and earnings for the quarter and six months ended June 30. A dividend of 13½ cents has been declared on outstanding shares, up from 11¼ cents paid in each of the three most recent quarters. It was paid September 30 to holders of September 4 record.

Sales of $3.65 billion for **Du Pont's** first 1981 quarter produced $201 million, or $1.35 per share in net income. Second quarter net income of $262 million, or $1.67 per share was made from $3.93 billion in sales. For its first six months, the company reported net income of $466 million, or $2.96 per share.

Sales for **Eagle-Picher's** second quarter, ended May 31, totaled $163.7 million. Net income was a reported $6.2 million, or 63 cents per share. The company reported $303,205,989 in net sales, $11,198,322 in net income, and $1.13 in per share income, for its six months, also ended May 31.

Englehard has declared a quarterly dividend of 14 cents per share, the first quarterly cash dividend paid by the new company. It was paid June 30. Since May 20, Englehard Corp. has consisted of Englehard Industries and the Minerals & Chemicals divisions of the former Englehard Minerals and Chemicals Corp.

Firestone Tire and Rubber said it earned $18 million, or 31 cents per share on sales of $1.08 billion for its third 1981 quarter. The quarter, ended July 31, was the third consecutive profitable quarter, following a year of losses. For its nine months, Firestone announced a profit of $65 million, or $1.12 a share on sales of $3.25 billion.

Fiscal 1980 sales for **Gates Rubber** reached $1,040,500,000. This is the first time the company's sales exceeded the billion dollar mark.

Earnings of $712,000, or 25 cents per share were reported for **Rogers'** 1981 second quarter. Sales totaled $26,604,000. Six months income from continuing operations was a reported $1,331,000, or 47 cents per share, from sales of $52,973,000.

Net income for **Union Carbide's** first quarter was reported to be $178 million, or $2.64 per share, on sales of $2.64 billion.

Upjohn announced first quarter 1981 sales of $482 million and net earnings of $52.2 million, or $1.74 per share. For its second quarter, the company reported sales of $513.9 million and net earnings of $40 million, or $1.33 per share. Six-month figures showed sales of $995.4 million with net earnings of $92.2 million, producing $3.07 a share.

For the three months ended March 29, **Wallace Murray** reported net income of $7,084,000, or $1.06 per share, on sales of $149,502,000.

Net income fell in **Wean United's** first quarter to $66,000 from first quarter 1980's $745,000, or 19 cents a share. This, on sales of $59.7 million, down 4% from last year's $62.2 million. The quarterly cash dividend, which paid 5 cents per share in the same 1980 period, was omitted in this year's quarter.

Net sales of $323,508,000 in **Witco Chemical's** first quarter produced net income of $5,895,000, or 64 cents per common share.

Yokohama Rubber and its 58 consolidated subsidiaries reported ¥3,951 million in ordinary profits, and ¥1,711 million in net profits. This, from sales of ¥251,799 million for the year, ended December 31, 1980.

Late News

Demand for industrial products to rebound next year RMA says

The Rubber Manufacturer's are predicting an end to the decline in industrial products sales next year and say that U.S. demand will increase almost 18% over the next five years. Sales are expected to reach almost $2 billion by 1986 for industrial hose, conveyor and other flat belting and V-belts. Sales for 1981 are expected to be about 12% over 1980. Hose sales are expected to be near $970 million, $320 million in sales of flat belting and $405 million for V-belts. For the year 1982 compared with the estimate for 1981, demand for hose is expected to increase about 5.7% to $1.025 billion. Flat belting is expected to increase about 3.1% to $330 billion in 1982. V-belts are expected to show the most gain, with an increase of nearly 6.2% to $430 million in 1982. The 1982 total of all three product areas is expected to amount to $1.785 billion, up from this year's estimate of $1.695 billion, for an increase of about 5.3%. Over the period of the next five years, through 1986, demand for hose is expected to rise to $1.15 billion, about 18.6%. Conveyor and other flat belting are expected to increase to $365 million, a rise of about 14.1%. Demand for V-belts should increase approximately 19.8% to $485 million in 1986. These figures would indicate an overall growth for the industry of almost 18% over the next five years. Aiding the hose and belt gains is the replacement automotive market which is going through its best year ever according to Paul Foley, Goodyear's manager of automotive replacement products. He cited increased driving by the public and better car maintenance as spurring the sales which are 10% above last year.

FORECAST

(Figures for 1980 in 80 dollars all others in 1981 dollars)
(Figures are in millions)

	1980	1981	1982	1983	1984	1985	1986
Hose	817	970	1,025	1,055	1,085	1,120	1,150
Flat Belting	324	320	330	340	350	355	365
V-Belts	367	405	430	455	465	475	485

RMA elects Brotzman

Donald G. Brotzman has been elected president of the RMA to take effect after his predecessor, Malcolm Lovell is confirmed as Under Secretary of Labor. For the last four years Brotzman has served as RMA's vice president-government relations and economic affairs. Prior to that he was an assistant secretary of the Army for Manpower and Reserve Affairs and a five term congressman from Boulder, CO. Lovell has taken a leave of absence from RMA while the Senate considers his nomination.

Goodrich suspends PVC, CVM expansion

BFGoodrich has suspended construction of polyvinyl chloride and vinyl chloride monomer manufacturing facilities at Convent, LA. BFG said the outlook for PVC consumption in the U.S. during the next two years has changed. The company expects significant recovery in demand to begin during the second half of 1982 rather than late this year or early next. BFG chemical group president Bart A. DiLiddo said "this delay does not reflect a change in our outlook for the growth of PVC demand over the decade or a change in our commitment to the PVC business. We intend to maintain our position in the industry." The VCM unit was to have a 1.6 billion pound capacity upon completion in 1983. The PVC facility was to be built in two phases. The first with 550 million pound capacity was to be completed in 1983 and the second, bringing annual capacity to 1.1 billion pounds was to be on stream in 1985.

More trucks to ride on radials

More than half of America's heavy duty trucks will be on radials by the end of 1983 according to Firestone's Robert Musel. Musel, tire marketing manager for the company said that new truck sales are expected to increase by some 46% during the next five years which will increase demands for replacement truck tires to record levels by the end of the decade. He said shipments of radial ply replacement truck tires are expected to jump from 1981's anticipated total of 4.7 million units to more than 9.4 million units by 1986, with the radial percentage moving up from 41 to 63%. Total replacement truck tire shipments are expected to increase from 11.4 million this year to 15 million by 1986.

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RMA industry rubber report
(figures are expressed in metric tons)

The data presented in this report has been compiled from U.S. Department of Commerce reports and from reports submitted monthly to the Rubber Manufacturers Association. The consumption figures have been compiled so as to represent 95 to 100% of United States consumption.

	June 1981	June 1980	Cum. 1981	Cum. 1980
Total new rubber				
New Rubber Available	220,010	182,953	1,496,323	1,495,644
Exports	31,262	41,741	213,096R	264,379
Consumption	211,468	161,395	1,311,738	1,248,930
Natural rubber				
Imports	51,278	45,173	345,348R	350,950
Stock Pile Deliveries	—	—	508	—
Re-Exports	1,328	1,576	9,011	12,249
Consumption	57,603	41,254	320,847	306,350
Synthetic rubber				
Production	158,184	129,638	1,078,596	1,084,805R
Imports	10,548	8,142	71,871R	59,889
Exports	29,934	40,165	204,085R	252,130
Consumption	153,865	120,141	990,891	942,580
% Total New Rubber	72.76	74.44	75.54	.75.47

Synthetic Rubber
(includes latex)

	June 1981	June 1980	Cum. 1981	Cum. 1980
Sbr				
Production	77,353	68,808	563,484	568,482
Imports	4,049	2,982	26,763	19,370
Exports	9,479	13,882	61,110	89,031
Consumption	83,059	63,785	530,431	510,847
Polybutadiene				
Production	27,069	18,394	177,480	162,578
Imports	2,480	1,835	16,929	14,839
Exports	2,620	2,349	19,889	18,459
Consumption	23,705	18,211	184,683	164,937
Nitrile				
Production	5,492	4,394	32,452	37,562
Imports	751	703	5,309	5,441
Exports	576	1,694	3,418	10,367
Consumption	6,389	4,561	36,293	32,799
Ethylene-propylene				
Production	14,928	4,954	90,537	81,851
Imports	123	—	124R	8
Exports	2,770	2,695	18,745	18,885
Consumption	12,796	7,334	69,292	59,125
Polychloroprene				
Production	11,470	9,601	74,369	84.949
Imports	103	291	1,100	2,958
Exports	3,561	5,606	26,802R	37,090
Consumption	7,935	7,112	49,413	53,880
Other synthetic elastomers				
Production	21,852	23,487	140,274	149,383R
Imports	3,042	2,331	21,646	17,273
Exports	10,928	13,939	74,121R	78,299
Consumption	19,981	19,138	120,779	120,992
Butyl				
Production	(D)	(D)	(D)	(D)
Imports	1,878	770	11,589	9,730
Exports	5,353	6,683	35,306	42,987
Consumption	12,806	11,362	68,337	65,951
Polyisoprene				
Production	(D)	(D)	(D)	(D)
Imports	781	1,365	7,448	6,482
Exports	609	521	4,193R	3,244
Consumption	3,181	4,941	27,565	32,605

Footnotes

* Figures include Polyisoprene and Butyl rubber but exclude Polyurethane rubber.
D Figures not released due to disclosure policy.
R Figures revised from those previously published.

Pricing, availability pose potential problems

by David L. Schultz, Editor

After four years of steady growth, the U.S. economy suffered a slump last year, and domestic chemical producers watched demand dwindle for most of their major product lines. It was a difficult year for the chemical industry with producers striving to keep selling prices in pace with soaring operating costs. The combination of high costs, lower output and sagging productivity contributed to the overall chemical industry slump. Production of chemicals dropped sharply last spring, dragging down output for 1980 as a whole approximately 5%. This decline was evident throughout almost all the industry's major product areas.

As a result of last year's disappointing industry performance, it has become evident that the economic environment for this decade will force chemical producers to make profound changes. In the area of petrochemicals, for example, fundamental changes must encompass the range of feedstocks used in the manufacture of olefins. As a result, producers will be in a better position to minimize inflation in raw materials costs and improve operating efficiency. For the overall chemical industry, there is a need for reassessment of the supply/demand balance in order to attain a reasonable level of profitability.

Petrochemicals

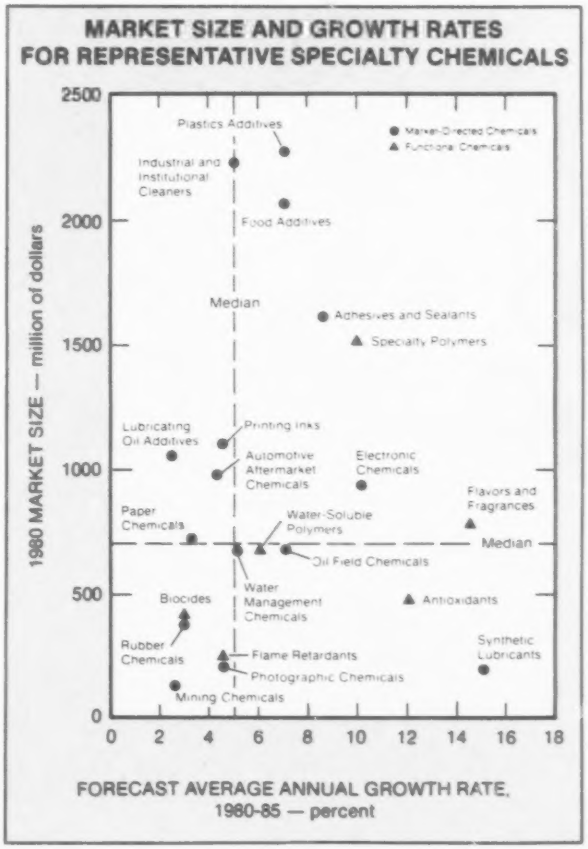
The basic petroleum raw materials for the production of chemicals are liquid hydrocarbon fractions (principally naphtha), refinery gases, natural gas and natural gas liquids, fuel oil and certain types of waxes. In the U.S., the relative abundance of natural gas and refinery gases has meant that light hydrocarbons have been the preferred feedstock for processes such as olefins production, while use of liquid feeds has been confined to aromatics manufacture.

In recent years, however, the depletion of natural gas reserves, combined with the high rate of growth in the chemicals sector, has increased the demand for liquid feedstocks such as naphtha. Outside the U.S., where suitable natural and refinery gases have been less readily available, liquid feedstocks are cracked on a large scale in plants specially designed to give high yields of base chemicals such as lower olefins. Feedstocks for chemicals now represent approximately 8% of petroleum consumption in Western Europe (about 5% worldwide) with a strong bias toward the lighter fractions.[1]

The petrochemical industry can expect to operate in a difficult environment for the balance of the 1980's. A number of distinct factors will serve to impact the industry on a negative basis. For example, a low growth in demand is expected in developed countries.[2] This expectation is based upon prevailing views defined by market saturation and consumer resistance to product prices resulting from OPEC-imposed energy prices.

A second major factor impacting the chemical industry is increased competition in world markets. Developing countries are well on their way to establishing their own petrochemical industries in an effort to meet domestic demand as well as to enter the world market. Unfortunately, a potential problem in this context is that some oil and gas-producing countries will make raw materials available to their own industries at prices which are unrelated to replacement costs. In the Persian Gulf, for example, gas-based petrochemical plants are already under construction; and these may well start to change the entire shape of the chemical industry. Whether the states involved will charge the natural gas at the price they could get for it on the open market remains to be seen. They have little interest in energy conservation compared with the consumer countries.

Another development adversely impacting the petrochemical industry is the continuing unpredictability in crude oil prices — specifically, *increased* prices. Since the 1973 oil crisis, prices and revenues have been adjusted for inflation and changes in exchange rates; as prices have risen, so have OPEC revenues. There is an inevitable time lag before the full effects of oil price changes become fully evident. But current forecasts for 1981, for instance, suggest that OPEC production will decline by approximately 7½% from 1980 levels. It follows that if OPEC nations


MARKET SIZE AND GROWTH RATES FOR REPRESENTATIVE SPECIALTY CHEMICALS

Feedstock Usage in Ethylene Production
W. Europe vs. the U.S.
(in %)

	1979		1986	
	W. Europe	U.S.	W. Europe	U.S.
Ethane		53	3.5	44
Propane		18	1.4	11
Butane		2	9.7	1
Subtotal	2.5	73	14.6	56
Naphtha	90.0	14	76.5	31
Gas oil	7.5	12	9.0	12
Subtotal	97.5	26	85.5	43
Refinery gas	negl.	1	negl.	1
Total	100	100	100	100

are to maintain their revenues at 1980 levels, they must increase prices by at least 7½% to compensate for this. With the current U.S. inflation rate hovering at 10%, OPEC would need to boost prices by a figure approaching 20% simply to remain at last year's revenue level. While it is difficult to predict the overall effects of such price increases on the global economy, one certainty is that raw materials costs will continue to escalate.

In view of these, and related developments, the petrochemical and polymer industries will have to improve operating efficiencies and secure their competitive positions in the marketplace. Improvements must be realized in the areas of raw materials (in terms of efficiency as well as purchase price), fuel and power consumption, manpower utilization and, most importantly, capital efficiency.

Difference in feedstocks

The dominant European feedstock for the production of olefins is naphtha as opposed to the U.S. where natural gas liquids dominate and where there is increasing use of gas oil as well.[2] A major factor influencing choice of feedstock is product yield pattern. Naphthas vary considerably in this respect. But of most interest to the polymer industry are the relative yields of ethylene, propylene and butadiene. Yields of the last two are higher from liquid feedstocks than from LPG and are negligible from ethane.

Naphtha-based ethylene production will remain predominant in Western Europe (61% in 1995), and it will only be replaced by heavier (gas oil) feedstocks which represented 4% in 1975 and is estimated to grow to 25% by 1985. But, as indicated above, the trend is completely different in the U.S. where ethane and LPG represent 3/4 of feedstock production leaving only 25% to naphtha and gas oil. In addition, ethane and LPG will decrease from 75% of total feedstocks to 40% in 1985.

Naphtha will have only 20% of the share while gas oil will play an increasingly important part with a 40% share. This trend illustrates that both in Western Europe and the U.S., an increased use of gas oil will result in an increased investment for ethylene plants (to 50%); increased by-product petrochemicals to be separated (14% propylene, 5% butadiene, 6% benzene and higher C_4/C_5 fractions; and increased energy/co-product yield which for gas oil, represents 40%, and will require serious energy-saving devices.

Ethylene. The most important petrochemical building block is ethylene. The use of heavier liquid feedstocks will dominate ethylene expansion through 1985; however, quantities of propane and butane will come on the world market from the Middle East. Even so, by-product credits for other olefins, diolefins and benzene made ethylene more economical when it is produced from heavier feedstocks. Most recent estimates predict an average 6% per year growth for ethylene through 1985; however, the market has been — and continues to be — subject to radical fluctuations. For example, after laboring for three years (since 1978), ethylene production by the end of 1980 had only reached the same 11 million metric tons that it had originally started from. Thermoplastics account for nearly 80% of all ethylene usage; and a 1979 upsurge in olefins was helped along by an increased thermoplastics consumption.

Styrene monomer. A key petrochemical in the world's chemical markets, styrene monomer is a major commodity chemical that has primary applications in several intermediate polymers. Combined, the U.S., Western Europe and Japan constitute 87% of the demand for styrene. In 1979, over eight million metric tons of styrene were consumed in the Free World. And demand is expected to grow to ten million metric tons by 1985 — a 3.5% compound annual growth rate. By 1990, the demand should top 12 million tons.

However, for styrene, general purpose rubber is a comparatively small outlet consuming only about 10%-15% of production. Almost all styrene is still made via the conventional direct dehydrogenation of ethylbenzene. Styrene monomer is an important building block, and thus far there is no alternative "low energy" technology. Thus considerable effort has been devoted to reducing the energy consumption of the existing process.

Butadiene. Butadiene is undoubtedly the most important monomer for general purpose rubbers. In the early sixties, the only process to make butadiene was the dehydrogenation of butane or butenes.[3] However, the unparalleled growth of the petrochemical industry during the sixties and early seventies was based on ethylene and propylene from liquid feed crackers which produce a C_4 coproduct stream from which butadiene could be recovered by extraction. Since this process is more economical than the established dehydrogenation route, it gained ground rapidly, especially in areas where ethylene production was predominantly based on naphtha/gas oil cracking.

The dehydrogenation of butane/butenes requires high temperatures and thus in the early seventies, this process was already three times as energy-intensive as the extraction process. Meanwhile, energy requirements for the extraction process have been reduced by process optimization resulting from considerably higher energy costs. As a result, the modern extraction plant uses only half the energy of its predecessor and one-fifth of the energy required by dehydrogenation units.

Styrene-butadiene rubber, one of the largest end uses for styrene, has been adversely impacted by the downsizing of automobiles and the increased use of radials. Radial tires use twice as much natural rubber as bias tires; consequently, less SBR is required. The transition to smaller, lighterweight vehicles has resulted in smaller, longer-mileage tires. This trend will also continue to influence SBR demand. SBR for tires represents about 60% of U.S. demand. Non-tire applications are varied, with footwear, cable and tubing accounting for the majority of the remaining 40%. The above-mentioned tire trends, as well as the depressed U.S. automotive industry, have contributed to suppress the 1980 demand by 21% below the 1979 levels.

But as the economy rebounds and as the U.S. auto industry recovers, SBR demand will recover, reaching 1979 levels by 1985. For the period 1985 to 1990, SBR demand will experience almost no growth — one-half percent per year at best. This projection is also impacted by energy considerations. But for the emulsion SBR process, there are areas for potential energy savings:

- increase in polymerization temperatures and conversion,
- improved finishing techniques.

Overall, however, it is clear that the cost of energy-per-ton of rubber has increased and will continue to increase substantially. When the higher costs of hydrocarbon feedstocks are taken into account, the cost increases have been and will continue to be even more dramatic.

Aromatics

The major concern in terms of aromatics is whether the synthetic rubber industry will be able to obtain the principal raw material, styrene. In the longer term (1981-1985), styrene will be available for the production of SBR, but the price of this critical raw material will rise dramatically.

Aromatics are produced by reforming and steam cracking from naphtha and other petroleum products. There is a direct line from naphtha to toluene to benzene since some of the toluene is converted to benzene. Benzene is then combined with ethylene to produce styrene. Being a petrochemical derivative, then, styrene costs will continue to rise in tandem with escalating feedstock prices.

Benzene. Oil companies will continue to dominate the production of aromatics during the next ten years since these products are made essentially in the catalytic reformers of oil refineries and in petrochemical complexes (olefin units). The total benzene demand between 1980 and 1990 will be determined by the demand for ethylbenzene/styrene which represents approximately 50% of the total demand throughout the decade. Uses for the other derivatives are expected to fluctuate slightly in relationship to one another; however, a significant deviation in benzene demand between 1980 and 1990 is not anticipated. Overall, total benzene demand in the 1980's is expected to increase by approximately 60%, or by roughly 930 million gallons, representing an average rate of growth of 4.9% per year.

In order to accommodate this increase, capacity utilization will have to increase. In 1980, for example, the 1.5 billion gallons of production represented a 60% utilization of total nameplate capacities of 2.5 billion gallons. Estimated operating rate in the U.S. will climb to 67% by 1985, and by 1990, the 2.45 billion gallons' demand will require nearly 86% operating rates.

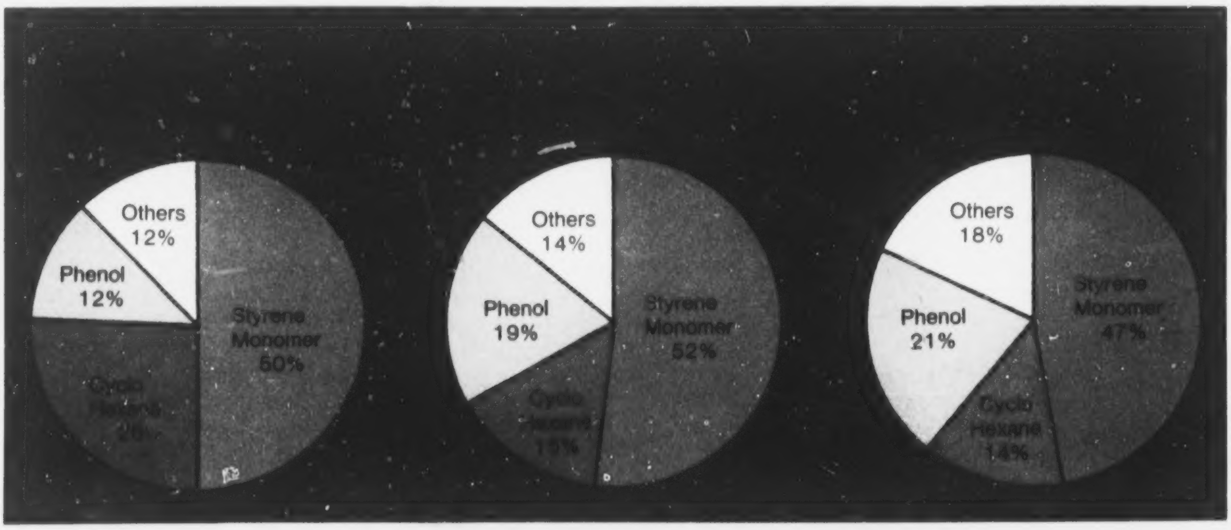
Toluene. This product is used essentially in the manufacture of polyurethane foams and other elastomers. The 1980 demand was very low because of the unusually small requirements for hydrodealkylation and disproportionation. This end use will require around two thirds of toluene consumption during this decade. Export sales were also low in 1980, representing less than half of the volume that has been sold on the export market during each of the five years prior to 1980. However, domestic production of toluene is expected to increase by 150 million gallons during the 1980-1990 period, while the volume of imports is expected to increase only moderately.

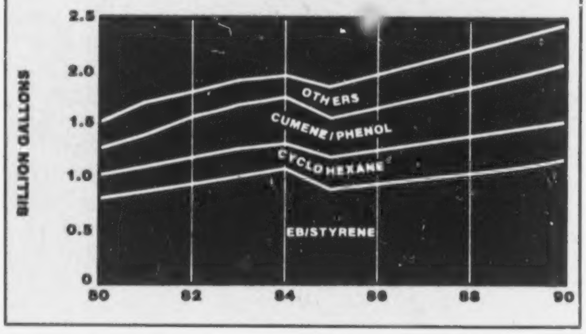
Rubber-processing chemicals

Raw rubber must be modified by a number of chemicals both to facilitate processing and to improve the quality and stability of the finished product. In 1980, an estimated 400 million pounds of synthetic organic rubber-processing chemicals were produced. About 290 million pounds or 73% of the total was sold on the merchant market. The remaining 110 million pounds was consumed captively by producers. Merchant dollar shipments amounted to approximately $380 million, and total shipments including interplant transfers are estimated at

U.S. Benzene Demand
Benzene Equivalent
MM Gallons

	1980	1982	1985	1990
LAB/BAB	41	48	52	60
Aniline	80	91	90	110
Cumene/Phenol	288	365	360	590
Cyclohexane	220	295	300	350
EB/Styrene	790	910	920	1220
Maleic Anhydride	42	52	50	50
Others	46	75	68	70
Subtotal	1507	1836	1840	2450
Export	12	15	10	—
Total	1519	1851	1850	2450





U.S. Benzene Demand

U.S. Toluene Supply
MM Gallons

	1980	1982	1985	1990
Domestic production	1550	1640	1500	1700
Imports	82	80	100	100
Total Supply	1632	1720	1600	1800

U.S. Toluene Demand
MM Gallons

	1980	1982	1985	1990
Benzene	465	675	565	820
Benzoic Acid, Benzyl Chloride	20	22	22	30
Phenol	10	12	12	15
Solvents	115	110	100	75
Other chemicals	45	50	50	80
Total domestic	655	869	749	1020
Exports	53	100	105	135
Total	708	969	854	1155

about $535 million. The U.S. exported $83 million worth of synthetic organic rubber-processing chemicals in 1979. Of this, about 32% consisted of antioxidants.

In the past ten years, physical production of rubber-processing chemicals grew at an average annual rate of 3.0%. Dollar shipments, including interplant transfers, grew at a much higher average rate of 12.1% per year. However, shortage-induced price increases of 32% between 1973 and 1974 and an additional increase of 28% in 1975 were largely responsible for this high growth rate. Since then, prices are estimated to have increased by roughly 10% per year, reflecting increasing crude oil prices. In constant dollars, shipments should reach $700 million in 1985.

The largest group of products accounting for 54% of the merchant dollar value in 1979, are antioxidants, antiozonants and stabilizers. All rubber products age through exposure to their environment, gradually losing their useful properties and in time disintegrating. As oxygen and oxidizing chemicals are two of the most common deleterious environmental factors, large quantities of antioxidants are used in rubber compounding. Chemically, they consist largely of two groups: arylamines and phenols. The amines are more effective in the presence of carbon black and are widely used where color is not important. Two of the more important arylamines are n,n'-diphenyl-p-phenylenediamine and n-phenyl-2-naphthylamine. However, the phenols are growing more rapidly since they are nonstaining. Although they are generally not as effective as the amines, they are usually adequate, and many rubber processors use them in both staining and nonstaining recipes.

Antioxidants. Antioxidants retard the rate of oxidation of substances and thus the gradual deterioration of a variety of rubber products. In 1980, the U.S. market for antioxidants was estimated at $240 million, including over $45 million worth of captively-consumed material by the rubber industry. The major antioxidants for non-food uses are aryl amines and phenols, but some sulfur compounds, certain acids, and phosphites are also used.

Food antioxidants, which require approval from the Food and Drug Administration (FDA), are mostly butylated hydroxyanisole (BHA), and propyl gallate. Butylated hydroxytoluene (BHT), the second largest food antioxidant, was removed from the "Generally Recognized as Safe" list by the FDA in May, 1977.

Antiozonants. These materials protect highly-unsaturated rubbers from attack by ozone, which causes severe cracking. Natural rubber and styrene-butadiene are particularly vulnerable to ozone, while other synthetics are quite resistant. The most effective antiozonants are p-phenylenediamine, dihydroquinoline, and metal salts of dithiocarbamic acid. Antiozonants work under dynamic conditions. Thus, by far, the largest usage is in tire sidewalls. Overall demand for antioxidants and antiozonants thus depends for the most part on the needs of the automobile industry. The industry's swing to the production of smaller cars with smaller tires will continue to affect total demand.

Inorganic fillers

One of the major consequences of the oil crisis has been an intensified effort in the search for low-energy content and low-cost materials suitable to be mixed with rubber in order to reduce the final cost and improve availability of polymeric raw materials. Based on energy and cost considerations, inorganic natural materials and derivatives appear to be an attractive choice.

The most widely-used fillers range from diluting fillers such as chalk or whiting to reinforcing fillers such as fine particle amorphous silicas. Some precipitated silicas have particle sizes and surface areas comparable to those of fine types of carbon blacks; but the reinforcing effect of the latter is considerably better.

This reduced reinforcing ability of non-black fillers is largely attributed to their own inorganic nature — thus their hydrophylic character — whereas most rubbers have a hydrocarbon structure and hydrophobic character. There is thus no affinity between both material types, wetting of filler particles by the rubber phase is poor and so are the filler-polymer interactions and final properties of the composite material.

But according to J. Royo[4], a very promising way of overcoming these and other minor deficiencies of inorganic fillers is by the use of coupling agents. These are difunctional organic compounds that by one end can interact with filler particles and by the other can do it with the rubber chains, acting as a bridge between the two very dissimilar materials.

Among the several types of commercially-available coupling agents, silane coupling agents are the most widely used. These agents can be added as such or in blends

Most widely used inorganic fillers for rubber compounds

Reinforcing effect

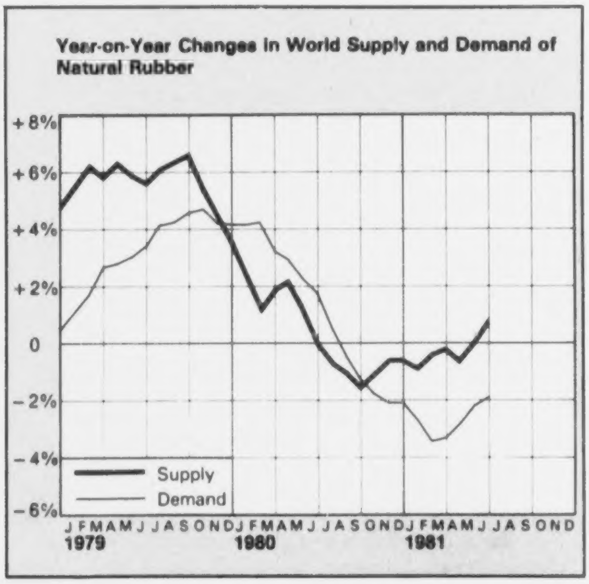
- Pyrogenic silica
- Fine particle precipitated silica
- Precipitated aluminum silicate
- Precipitated calcium silicate
- Hard clay
- Talc
- Precipitated calcium carbonate
- Soft Clay
- Whiting

with inert materials for easier handling during the mixing process or can be pre-reacted with the filler. Since silane coupling agents are comparatively expensive, their use even at the low levels required has a negative effect on the final cost. Alternate commercially-available materials, such as titanates and calcium carbonates, however, appear to render less satisfactory final results.

Natural and synthetic rubber

Latest statistical data compiled by Landell Mills Commodities indicates a steady slide in prices of all grades of natural rubber in all markets. RSS1, for example, has declined almost 9% from previous levels. The International Rubber Study Group's estimates of the overall balance of natural rubber demand and supply in 1980 and 1981 support the view that it was in surplus, not deficit, last year.

In terms of synthetic rubbers, price increases of 7%-9% have been realized. In Europe the price paid by large tire companies for 1502 SBR, for example, has risen by 7.5% to the equivalent of 55 U.S. cents per pound — the prevailing price in Europe. The price for oil-extended varieties has risen somewhat more. Isoprene monomer is in short supply; and thus its price has risen by 12%. In the longer term, however, supply will be increased as a result of the agreement reached between BFGoodrich and Shell to reactivate a 50,000 ton capacity isoprene unit in Texas, which was closed in 1978. In the short term, however, the price of polyisoprene rubber is expected to reflect higher production costs. The practice of linking low-cis polyisoprene prices to those of natural rubber is increasingly unattractive to IR producers, and no further new contracts of this type are being offered. The prevailing price in Europe for the low-cis variety is approximately 27% higher than natural rubber (the ratio for high-cis IR is about 66%), and full production costs are about 15% higher yet.



Year-on-Year Changes in World Supply and Demand of Natural Rubber

Reversing the historical trend, natural rubber is expected to outpace synthetics in the long-term future. Natural rubber will account for 33% of world rubber demand by 1995 compared to 29% in 1979. The expected slippage in synthetic rubber consumption will occur in part as a result of higher feedstock costs. Increasing feedstock costs, inflationary pressures, and higher capital costs are inevitable, and the upward price trend will continue.

Current forecasts call for a 4.6% annual growth rate in world demand for natural rubber to nearly 8 million metric tons in 1995 from 13 million metric tons in 1979, an annual growth rate of 4% overall. In addition to its price competitiveness, natural rubber is expected to benefit from comparative price stability. In the past, natural rubber's major drawback has been erratic pricing caused by short-run price inelasticities; but the 1979 International Rubber Agreement on price stabilization has set the mood for expansion of the natural rubber industry.

Technological innovations will also improve natural rubber's world position; and the use of advanced planting and harvesting techniques will increase yields, as will the introduction of guayule and other hardier strains. Other changes in the rubber industry will occur as nontire applications consume an increasingly-larger share of rubber output. In 1979, for example, tire makers consumed 5.9 million metric tons of rubber, or roughly 45.4% of the total demand. In 1995, however, tires will account for only 39.6% of total rubber demand, or 9.6 million metric tons, representing an annual growth rate of 3%.

Non-tire demand, meanwhile, will increase by 4.7% a year to 14.7 million metric tons in 1995 from just over 7 million metric tons in 1979. The faster growth rate in non-tire rubber consumption is attributed to the need for industrial rubber products among the developing nations, while the slowdown in tire rubber consumption is blamed on the depressed auto market in developed countries and on longer-life radials which have hurt replacement demand.

Conclusion

The rubber and related chemical industries suffered from last year's economic slump and are expecting a return to pre-recessionary levels of profitability in the near-term future. But the rubber industry is highly dependent on the automobile industry which continues to suffer as a result of general economic conditions. And while some immediate relief from last year's depressed levels is justly expected, the possibility of future general economic downturns must be taken into consideration.

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Extender oils for synthetic rubber

*by Gordon S. Cochrane, Vice-president/Lubes,
and Robert G. Stewart, Senior Analyst/Lubes
Planning & Development, Sun Petroleum Products
Company, Philadelphia, PA*

Introduction

February, 1981, marked the thirtieth anniversary of the first use of extender oils in synthetic rubber. In 1951 an oil-extended masterbatch of SBR was first produced and by the end of that year 70 million pounds of oil had been consumed in SBR. Today, oil-extended SBR contains about 25% oil. In 1980, the U.S. consumed an estimated 270,000 metric tons of oil for SBR extension and Western Europe about 150,000 tons. Additional volumes were consumed for polybutadiene and EPDM and for other minor uses.

Extender oils are defined as petroleum oils that are added to elastomers at the place of polymer manufacture. Oils that are added at the point of manufacture of rubber products, called processing or compounding oils, are not included; although those oils will be considered when projecting future supply of oils. The volumes of processing or compounding oils are rather difficult to estimate since statistics on them are not readily available from any source.

The use of extender oils has provided major economic and physical property advantages to the synthetic rubber industry. The most obvious advantage is the increased volume of finished elastomer that results from the incorporation of extender oils. Secondly, the extender oils are one of the lowest-cost components of synthetic rubber despite the large price increases of oil in recent years. Finally, the use of oil permits the producer to react his polymerization to the optimum molecular weight. Then the rubber can be modified by adding aromatic or naphthenic extender oil to achieve the desired properties.

The advantages of using extender oils are also apparent in the finished rubber product. Benefits are achieved in handling, processing, and finished-product quality because of the inclusion of the extender oils and the addition of more oil for compounding and processing. Tires produced from oil-extended SBR vulcanize to give better traction, lower heat generation, and a softer ride than tires made from SBR that has not been oil-extended.

Types of extender oils

There are three basic types of extender oils. In order of consumption they are: aromatic, naphthenic, and paraffinic. Aromatic oils comprise about 80% of all extender oils with naphthenics filling almost all of the remaining 20%. Use of paraffinic oils is small but growing since these oils find increasing use in ethylene-propylene-terpolymers (EPDM), one of the fastest-growing elastomers.

Aromatic oils are primarily of the ASTM 101 or 102 types which are highly aromatic and contain no more than 20% or 35% respectively of saturated hydrocarbons. These oils exhibit excellent compatibility with SBR and polybutadiene, are dark in color, and are relatively inexpensive compared to naphthenics. Tensile, tear, and flex properties are maximized by using these oils. Volatility losses are minimized by the high viscosity and molecular weight of the aromatic oils. Table I summarizes the effects on elastomer properties and their compatibility with various polymers.

Table I[1] Polymer compatibility and general effect on properties

Polymer compatibility	Aromatic Oils (Sundex)* Type 101 Type 102	Naphthenic Oils (Sunthene)* (Circosol)* Type 103
SBR	excellent	good
Cis-Polybutadiene	excellent	good
Polyisoprene	excellent	excellent
EPM	not recomm.	good
EPDM	not recomm.	excellent
General properties		
U.V. light stability	poor	excellent
Volatility loss	slight	slight
Low temp. properties	poor	good
Processing ease	excellent	good
Non-staining	poor	excellent
Tensile-modulus hardness	good	good

*Registered Trademark Names of various Sun companies

Naphthenic oils are also categorized in the preceding table. These oils comprise about 20% of the total extender oil consumption on a worldwide basis. (Their use is higher in the U.S. than in the rest of the world since naphthenic crude oils are found primarily in North America). The naphthenic oils produced from these special crudes are characterized by saturates content of 35% to 65%. They are excellent extenders because of their good processing and compatibility characteristics, but their principal advantage is their non-staining property.

Paraffinic process and extender oils are just now becoming significant. They provide low volatility and good U.V. stability, principally for EPDM applications at high temperatures. When combined with naphthenic oils, a desirable balance of solvency and light stability properties can be achieved.

Extender oil demand

One of the primary purposes of this presentation is to describe the present and future demand for oil extenders for synthetic rubber. Despite the availability of worldwide rubber industry statistics, information on extender oils is very difficult to obtain and on compounding and processing oils, nearly impossible. Much of this information is regarded as proprietary; thus it is not available from the usual rubber industry sources. Nevertheless, based on rubber production statistics available through 1979, we feel that we can confidently describe the recent consumption levels of extender oils and project demand for the next few years.

Before turning to demand for oil extenders, let us examine what has occurred in synthetic rubber consumption since 1973 and what is projected for the future:

Table II[2] World synthetic rubber production

Year	m metric tons	% of total rubber produced
1973	7,708	68.7
1974	7,552	68.7
1975	6,855	67.4
1976	8,030	69.2
1977	8,470	70.1
1978	8,865	70.0
1979	9,270	71.0

These data show the drop in rubber production that resulted from the 1975 recession and the subsequent recovery that lasted through 1979. However, the healthy growth that was experienced between 1975 and 1979 was not uniformly distributed. Developed economic regions did not show the same growth pattern as the world overall. For example, the U.S. experienced the following pattern:

Table III[2] U.S. synthetic rubber production

Year	M metric tons
1973	2,627
1974	2,498
1975	1,941
1976	2,304
1977	2,417
1978	2,475
1979	2,528

The peak production of synthetic rubber occurred in 1973 and that level has yet to be achieved again. The estimated 1980 U.S. production fell to about 2,010M tons, a drop of 20%. Western European production suffered a drop of approximately 4% from 1979 to 1980. Thus, much of the increase in demand over the last seven years has come from the developing nations and the Far East.

Having briefly examined the recent history of synthetic rubber production, let us look at the projection of future demand. Although several forecasts were available, they did not vary to any great degree. The following table presents the latest IISRP estimate:

Table IV[3] World synthetic rubber consumption forecast — m metric tons

	1979	1980	1981	1985	199
North America	2,576	2,127	2,308	2,665	2,94
Western Europe	1,619	1,564	1,592	1,807	2,01
Middle East, Africa	113	123	128	156	19
Latin America	450	539	578	779	1,13
Australia/Asia	1,180	1,291	1,335	1,614	1,97
Eastern Europe*	2,500	2,650	2,800	3,350	4,10
TOTAL	8,438	8,284	8,826	10,371	12,36

*Estimated

These latest IISRP forecast numbers are significantly lower than the ones published last year. We believe that for 1981 the forecast may still be optimistic, with U.S. growth flat and Western Europe showing a slight decline. Our belief is founded on a low level of tire sales with a significant recovery delayed for several years.

In terms of extender oils, the growth of individual elastomers is important since some use no oil and others require substantial amounts. However, SBR is expected to hold over 50% of total synthetic demand and the fastest growing elastomers, the EPDM's, are large consumers of oil. Oil demand for extender use should grow at a slightly greater rate than overall synthetic rubber demand.

In addition to the effect of future production levels of extendable rubber on the future demand for extender oils, there are several other factors that will influence future demand levels for extender oils:

1. Oil is likely to remain the lowest-cost ingredient in the elastomer as well as in the compounded rubber, thus the economic driving force will be to use more oil.
2. Increasing prices of naphthenics relative to aromatics may lead to substitution of aromatics for naphthenics in those instances in which staining is not a problem.
3. Increased production of EPDM will take additional quantities of oil, both paraffinic and naphthenic, because of the higher oil loading.
4. The growth of the synthetic rubber industry will be heavily influenced by the tire market. The change to radial tires in the U.S. should lead to lowered demand for SBR and greater demand for natural rubber. This effect may be less than might be expected, because the escalating price of natural rubber may lead to less than the optimal level of use of natural rubber. To date, the predicted substitutions of natural rubber for SBR is not in evidence. In Western Europe and Japan, the use of radial tires is well established; thus this trend will not affect their markets.
5. Other products such as styrene block copolymers will require increasing amounts of oil.

In addition to tires, other rubber products are expected to show strong demand growth. Combining these factors and considering the forecast demand for synthetic rubber in various parts of the world, the following demand levels for extender oils are projected:

Table V Past and projected extender oil demand m metric tons

	1975	1979	1980	1985
North America	276	305	255	320
Western Europe	205	210	186	217
Middle East/Africa	14	15	15	18
Latin America	47	58	66	93
Australia/Asia	96	151	125	147
Eastern Europe	237	300	318	402
TOTAL	875	1,024	965	1,197

The oil extender demand levels shown above were calculated by relating *total* synthetic rubber demand to consumption of oil extenders. In earlier years, approximately 13% by weight of total synthetic rubber produced was oil content; that level was 12% by 1979. The overall demand levels are significantly lower than previous projections. The sharp drop in elastomer production in 1974 and 1975 resulted in sharply lower oil demand.

As reported previously, U.S. demand for synthetic rubber has not yet attained the 1973 level of production and the steady growth evidenced between 1975 and 1979 ended with a decline in 1980, a decline that affected most of the developed rubber-producing nations. If the recent synthetic rubber demand projections are correct, free world demand for extender oils by 1985 will not greatly exceed the demand in 1979. From 1980's low demand level of 965M metric tons, annual growth for the free world is anticipated to average 5.7%/year through 1985. However, this is probably on the high side as we expect little growth in the U.S. and Europe for 1981.

One further issue needs to be addressed before leaving the subject of oil demand. The same types of oils that are utilized for extension of synthetic rubber are also required for processing and compounding at the place of manufacture of rubber products. As stated earlier, the quantities of oil consumed for these uses are not easily obtained, even for the U.S. market. However, as an oil refiner we have some idea of the amount of these oils being consumed.

In a 1977 paper Mr. Irwin Johnson[4] estimated that process oils represented about 57% of all rubber oils consumed in 1970 in the U.S., but that the percentage would decline to 50% by 1980 as radial tire demand grew and demand for EPDM elastomers increased. If we add that percentage to the demand figure for extender oils presented in Table V, the total demand for all rubber oils is double the amount projected for extender oils alone. In the U.S. naphthenic oils account for 60% of these process oils, aromatics 30%, and paraffinics 10%. Outside the U.S., the naphthenic percentage is much lower with a consequent increase in the percentage of aromatics used. The exact percentages in the remainder of the world are not known.

Rubber oil supply

Now that the demand question has been addressed, the next question concerns the available supply. Just by examining the slowly-increasing demand figures, one might conclude that supply capability will be adequate to meet demand. In general, that is a true conclusion but there are several points to be examined. Is the free world's supply capability increasing in the areas in which extender oil demand is increasing? Will there be ample supply of each type of oil: aromatic, naphthenic and paraffinic? Will the pricing relationships among these oil change? Will the quality level of the oils remain the same in the future?

Aromatic oils

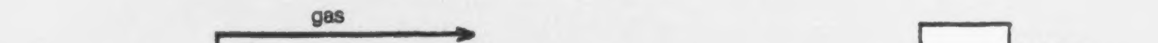
Aromatic oils are a by-product of solvent-refined lubricant manufacture, but not all paraffinic lube plants produce aromatic oils. There are two reasons why the production of aromatics may be avoided. If the crude used is sufficiently low in aromatic content, it may not be necessary to solvent extract in order to produce a satisfactory lubricant.

The second major influence on aromatic oil production concerns the type of processing employed by the refiner. Since aromatic oils can be used as a fuel component, the producer may use them for that purpose. They can also be utilized for the production of asphalt. If the producer chooses to produce an extract oil suitable for rubber usage, he must further distill and probably blend to produce a consistently high-quality aromatic extract. The schematic drawing (Figure 1) outlines the processing steps required for a refiner who does produce extracts for rubber extension.

In the free world, the consumption of aromatic extracts represents only about 3.5% of the total paraffinic lube oil production. In the U.S. this percentage is just under 5%. For producers like Sun Oil who are active in the extract market, this percentage can be as high as 10% to 15%.

The world capacity for producing aromatic extracts greatly exceeds the present and anticipated demand for these products. Any increased demand could be met provided the economic rewards were adequate. In fact, the world's ability to produce aromatic oils *greatly* exceeds

Figure 1



the present consumption of these products; most extracts are utilized for fuel or minor products rather than as extender or process oils. For example, in the U.S. in 1979, aromatic extract sales for all uses totalled just under 133 million gallons. The capacity to produce extracts is approximately 335 million gallons. As stated earlier, additional processing would be required to produce acceptable rubber oils; but the capacity is in place.

Much of the predicted growth in synthetic rubber is occurring in the Far East, Latin America, and other developing regions. The same economic forces leading to increased rubber demand are also creating an increased demand for lube oils. The following table shows the estimated free world lubricant capacity for 1980 as well as two projections of 1985 capacity: an estimated capacity level if only the "firm" or "announced" projects are completed, and a higher projection if some of the more tentative expansions occur.

Table VI: Free world lubricant capacity mb/cd

	1980	1985	
		probable	probable & possible
North America, EX. U.S.	29.4	30.9	30.9
U.S.	222.2	223.4	226.8
Central America & Caribbean	24.7	25.2	25.2
South America	25.7	30.7	34.6
Western Europe	139.2	140.7	153.5
Middle East	15.2	29.2	33.0
Africa	7.9	16.9	17.3
Far East/Australia	100.8	108.8	115.1
	565.1	605.8	636.4

Note that the largest increases in lube manufacturing capacity are occurring in exactly the same world regions in which the highest growth in rubber demand is forecast. Not only will world lube capacity remain far above the level required to produce sufficient extract volumes, but this capacity will also be available in each of the world's major economic areas.

Naphthenic oils

Unlike aromatic extract oils, naphthenic oils are a purposefully manufactured lubricant. They are produced primarily, but not exclusively, in the United States which possesses nearly all of the world's sweet naphthenic crude oil reserves. Naphthenic lube producers select a particular slate of crudes to produce naphthenic products that meet the quality and product specifications that are desired. Since Sun has always been a major supplier of naphthenic rubber oils, the qualities and properties that we desire are those that make superior rubber oils.

Outside the U.S., naphthenic lubricant producers must rely principally on Venezuelan crudes, some of which resemble U.S. naphthenics, but most of which are heavier and much higher in sulfur content. They are universally regarded as inferior crudes and are presently refined to produce lube oils of lower quality; however, with sufficient processing they can be used to manufacture lubes of similar quality to those produced from U.S. sweet crudes.

In recent years the problem of adequate naphthenic crude supply has become acute. In 1979 U.S. producers were forced to allocate available supplies because demand for products exceeded the available supply. Because of the overall shortage of crude oil, some naphthenic lube crudes were bid away from lube manufacturers by refiners who used them only to make fuels.

The turndown in the U.S. economy and particularly the depressed state of the synthetic rubber industry have temporarily relieved the supply crunch; but U.S. naphthenic crude production continues its inexorable decline at a 10%/year rate. The protracted recession in the rubber industry has relieved the supply crisis, but steps must be taken to asssure adequate naphthenic supplies in the future.

We anticipate that both naphthenic demand and supply will continue to decline through 1985, but renewed demand growth will begin after 1985. By that time additional supply should also be available. The heavy Venezuelan crude reserves will certainly be developed. Additionally, new processes, specifically catalytic dewaxing of crudes, can be utilized to produce naphthenic-type products from some of the world's low-wax crudes. Thus we anticipate no future shortage of naphthenic rubber oils. By 1990 world demand for naphthenics will have returned to the high level of the mid-1970's.

Beyond the problem of crude supply, the manufacture of suitable quality naphthenic extender oils requires segregated lube facilities. Naphthenic crude and products must be kept entirely apart from paraffinic ones; thus these products are much more expensive to produce than the aromatic oils.

Future trends in extender oils

The recent shortage of naphthenic products and the consequent price increase that placed them at nearly the price levels of comparable paraffinic oils has caused much concern about the future for naphthenics and raised questions about the future costs of naphthenics. The likelihood of additional supply has already been discussed and Sun, among others, intends to remain a producer of naphthenic extender oils.

When the shortage of naphthenics occurred in 1979, the greater increase in the prices of naphthenics over those of paraffinics drove much of this price-sensitive market away from naphthenics. This market has now virtually disappeared, although the current recession has allowed parts of it to revive. The higher naphthenic prices have had the effect of directing naphthenics to those performance markets, like synthetic rubber, that really require their properties.

In the future, naphthenic prices will be much closer to paraffinic prices and both will advance at a greater rate than the by-product aromatic extracts for which there is more than adequate capacity. It is very difficult to predict the short-term direction of naphthenic prices. A major economic recovery before 1985 will again put pressure on the dwindling reserves which could escalate prices, but after 1985 new capacity should be available and long-term naphthenic prices will not be substantially above paraffinics.

The problems with aromatic oils arise not from inadequate capacity or shortage of raw material supply, but from the necessity for refiners to run less desirable crudes. In times of crude shortage this becomes a severe problem forcing producers to make lube oils from less than optimal crude oils. Some recent improvements in solvents for the extraction process will help alleviate this problem, but the refiner's ability to produce a consistently high-quality ex-

(continued on page 67)

Extender Oils

(continued from page 47)

tract may be impaired.

There are other processes that could be used to improve the quality of extracts, but they are expensive and would significantly increase the cost of the products. Through use of hydrogenation the refiner can manufacture extender oils with more consistent quality and with substantially reduced levels of compounds containing sulfur, nitrogen, and oxygen. Aromatic oils could be used for light-colored rubber applications after such treatment. The removal of these polar compounds will improve the aging characteristics of rubber and result in products with better oxidation stability and high-temperature performance. However, the improvements in rubber quality are not sufficient to offset the increased costs at today's prices.

In summary, barring a major international crisis, we see no long-term shortages of extender oils and only the remote possibility of a short-range tight naphthenic supply situation. After the period of adjusting to new crude sources and/or new processing, the rubber industry will have available adequate supplies of oils that are very similar to today's products. To aid this effort to produce the products required for polymer production, a high level of cooperation and communication between refiners and rubber producers will be required so that significant progress can be made to maximize the value and utility of the crude oil barrel and the elastomers that are produced. By working together, the myriad and complex problems facing our industries can be resolved to our mutual benefit.

EQUIPMENT FOR SALE

MILLS 16" x 42" Unitized 60 hp
6" x 12" Farrel Lab Mill (2)
26" x 84" Eemco, Unitized
60" unitized mill, reducer & 150 hp, rebuilt
60" Farrel with reducer 100 hp drive

PRESSES 200 ton, 24" x 30"
270 ton, 42" x 42"
680 ton W • W w/41" x 66" platens
150 ton Nordberg 24" x 24" w/pump
400 ton 42" x 42", w/pump
50 ton PHI 12" x 12", w/pump
600 ton 30" x 30", self contained (3)
180 ton 44" x 80", w/pump (2)
250 ton 36" x 40", 44" daylight
500 ton 60" x 120"
250 ton Bliss, 54 x 40

CUTTERS
36" Spadone x 30" stroke
#20 & #43 Cumberland
Farrel Bale Cutter

VULCANIZERS
7' x 7' Vert. 100 psi
5' x 18', 125 psi
10' x 15', 50 psi
6'6" x 75', 150 psi
8' x 15', 100 psi

MISC
2500 Ton Bliss Lead Extrusion
Press, New 1974, 300 & 600
ton Lewis rubber inj. molder

LIQUIDATING
2—#1 Farrel Banbury Mixers
3—Unitized 2-Roll Mills 24"-36"
4—Jacketed Ribbon Mixers
10—Hydraulic Presses, w/Pumps
1—4½" Royle #3 Extruder
4—14" x 30" 2-Roll Mills
Uni-Drive

CALENDERS 24" x 66" Farrel 3-roll
26" x 72" 3-roll
6" x 12" Farrel 3-roll
42", 48" & 66" 4-roll inverted "L"
28" x 78" 4-roll inverted "L"
60" Farrel 3-roll
36" Farrel 2-roll
16" w/roller die & 2-roll calender

EXTRUDERS 6" Royle cold feed
15" Bolling, 600 hp
15" x 12" Farrel w/pelletizer
4½" Royle, 50 hp
3½" NRM Cold Feed, 75 HP DC
3½" NRM tuber, 6" Royle tuber
2" Royle 14/1 Cold Feed, Cross Hd

MIXERS #1 & #3A Farrel Banbury
B Banbury
#00 Farrel Banbury
#3 Bolling, 100 hp
#9 Farrel, 400 hp
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